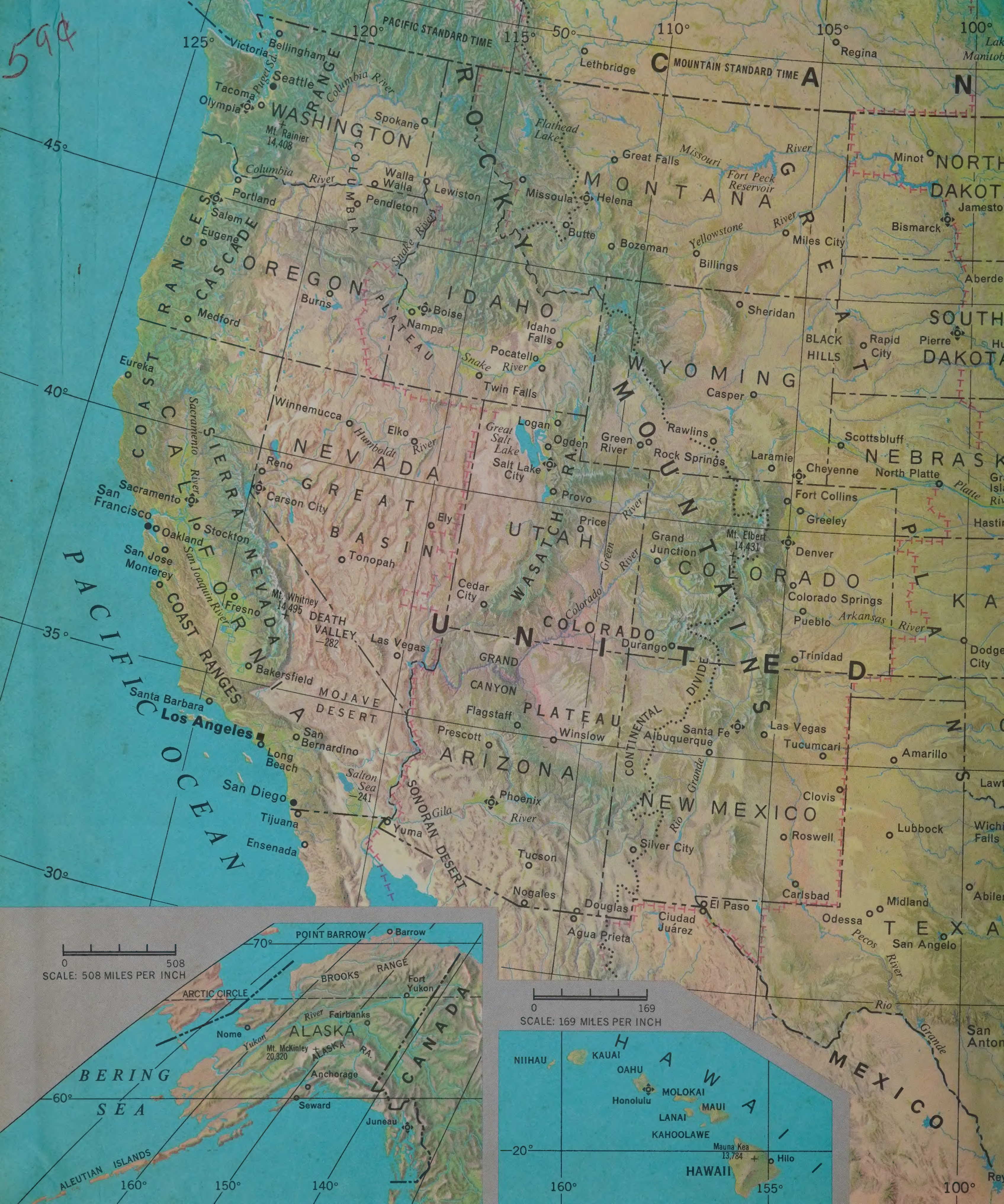
59¢


PACIFIC STANDARD TIME
MOUNTAIN STANDARD TIME
125°
120°
115°
110°
105°
100°
50°
45°
40°
35°
30°
Victoria
Bellingham
Puget Sd.
Seattle
Tacoma
Olympia
Columbia River
WASHINGTON
Mt. Rainier 14,408
Spokane
Walla Walla
Lewiston
Pendleton
Portland
Salem
Eugene
Medford
OREGON
Burns
CASCADE
RANGE
COAST RANGES
COLUMBIA PLATEAU
Snake River
Boise
Nampa
IDAHO
Idaho Falls
Pocatello
Twin Falls
ROCKY MOUNTAINS
Flathead Lake
Missoula
Helena
Butte
Bozeman
Great Falls
Missouri River
Fort Peck Reservoir
MONTANA
Yellowstone River
Billings
Miles City
Lethbridge
Regina
CANADA
Lake Manitoba
Minot
NORTH DAKOTA
Jamestown
Bismarck
Aberdeen
SOUTH DAKOTA
Pierre
Rapid City
BLACK HILLS
GREAT PLAINS
Sheridan
WYOMING
Casper
Rawlins
Green River
Rock Springs
Laramie
Cheyenne
Scottsbluff
North Platte
Platte River
NEBRASKA
Grand Island
Hastings
Eureka
Sacramento River
Sacramento
San Francisco
Oakland
Stockton
San Jose
Monterey
San Joaquin River
Fresno
Mt. Whitney 14,495
DEATH VALLEY −282
SIERRA NEVADA
CALIFORNIA
Reno
Carson City
Winnemucca
Humboldt River
Elko
NEVADA
GREAT BASIN
Ely
Tonopah
Las Vegas
Great Salt Lake
Logan
Ogden
Salt Lake City
Provo
Price
UTAH
WASATCH RANGE
Cedar City
Green River
Grand Junction
Mt. Elbert 14,431
COLORADO
Denver
Fort Collins
Greeley
Colorado Springs
Pueblo
Arkansas River
Trinidad
Durango
Colorado River
KANSAS
Dodge City
UNITED STATES
Bakersfield
COAST RANGES
Santa Barbara
Los Angeles
Long Beach
San Bernardino
MOJAVE DESERT
Salton Sea −241
San Diego
Tijuana
Ensenada
PACIFIC OCEAN
GRAND CANYON
Flagstaff
Prescott
Winslow
COLORADO PLATEAU
ARIZONA
Phoenix
Gila River
Yuma
SONORAN DESERT
Tucson
Nogales
Douglas
Agua Prieta
CONTINENTAL DIVIDE
Santa Fe
Albuquerque
Las Vegas
Tucumcari
Rio Grande
NEW MEXICO
Silver City
Clovis
Roswell
Carlsbad
El Paso
Ciudad Juárez
Amarillo
Lubbock
Wichita Falls
Lawton
Midland
Odessa
Abilene
San Angelo
Pecos River
TEXAS
Rio Grande
San Antonio
MEXICO
0
508
SCALE: 508 MILES PER INCH
POINT BARROW
Barrow
70°
BROOKS RANGE
Fort Yukon
ARCTIC CIRCLE
Nome
Yukon River
Fairbanks
ALASKA
Mt. McKinley 20,320
ALASKA RA.
Anchorage
Seward
Juneau
CANADA
BERING SEA
60°
ALEUTIAN ISLANDS
160°
150°
140°
0
169
SCALE: 169 MILES PER INCH
HAWAII
NIIHAU
KAUAI
OAHU
Honolulu
MOLOKAI
MAUI
LANAI
KAHOOLAWE
Mauna Kea 13,784
Hilo
HAWAII
20°
160°
155°
100°
Rey

stereo MANUAL 68P63010A79

MODELS SK540C, SK555C THRU 558C, SK660C, SD661C THRU 663C

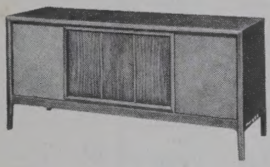
CHASSIS HS-2338, HS-2346, HS-62249, NCHS-62257 & PCHS-62257

MOTOROLA service manual

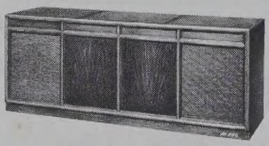
MODELS SK540C, SK555C THRU 558C,
SK660C, SD661C THRU 663C
CHASSIS HS-2338, HS-2346, HS-62249,
NCHS-62257 & PCHS-62257

MANUAL 68P63010A79

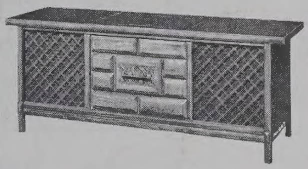
stereo



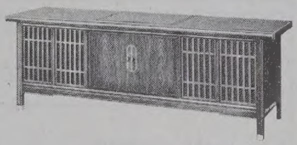
MODEL SK540C



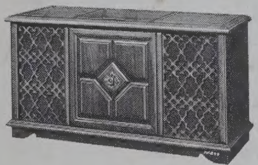
MODEL SK555C



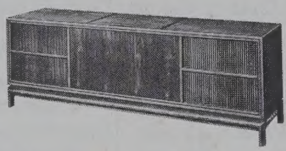
MODEL SK556C



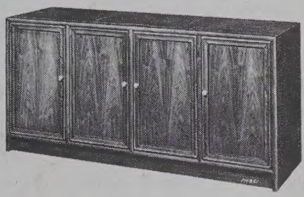
MODEL SK557C



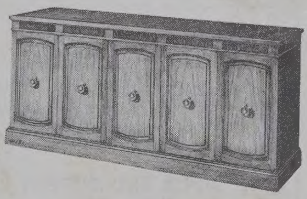
MODEL SK558C



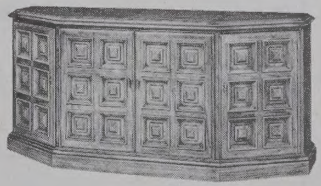
MODEL SK660C



MODEL SD661C



MODEL SD662C



MODEL SD663C

GENERAL INFORMATION

ELECTRICAL SPECIFICATIONS

Power Supply: 120 volts, 60 cycle AC only.

Power Consumption:

SK540C	150 watts
SK555C Thru 558C	200 watts
SK660C, SD661C Thru 663C	250 watts

RELATED PUBLICATIONS REFERENCE

Record Changer:

Model SK540C	VM122RC
Models SK555C Thru 558C	VM122RC
Model SK660C	VM123RC
Models SD661C Thru 663C	VM123RC

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PART NO. 68P63010A79 3-67 PRICE 65 CENTS
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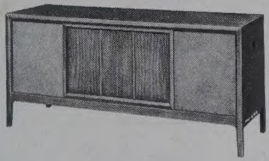
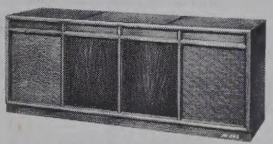
stereo MANUAL 68P63010A79

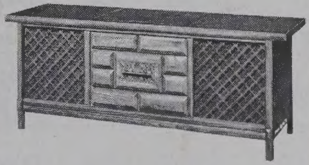
MODELS SK540C, SK555C THRU 558C, SK660C, SD661C THRU 663C

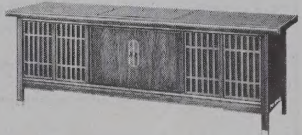
CHASSIS HS-2338, HS-2346, HS-62249, NCHS-62257 & PCHS-62257

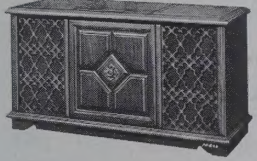
MOTOROLA service manual

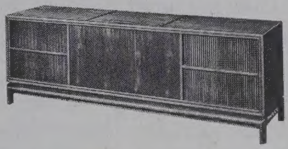

MODEL SK540C

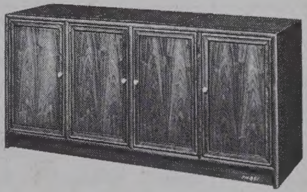

MODEL SK555C

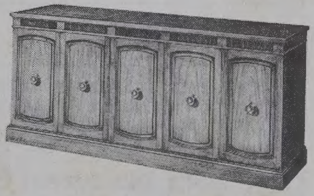

MODEL SK556C

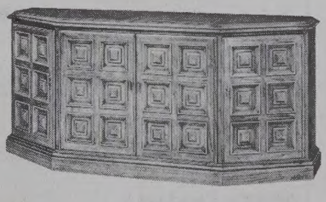

MODEL SK557C


MODEL SK558C


MODEL SK660C


MODEL SD661C


MODEL SD662C


MODEL SD663C

GENERAL INFORMATION

ELECTRICAL SPECIFICATIONS

Power Supply: 120 volts, 60 cycle AC only.

Power Consumption:

SK540C	150 watts
SK555C Thru 558C	200 watts
SK660C, SD661C Thru 663C	250 watts

RELATED PUBLICATIONS REFERENCE

Record Changer:

Model SK540C	VM122RC
Models SK555C Thru 558C	VM122RC
Model SK660C	VM123RC
Models SD661C Thru 663C	VM123RC

MODELS SK540C, SK555C THRU 558C, SK660C, SD661C THRU 663C
CHASSIS HS-2338, HS-2346, HS-62249, NCHS-62257 & PCHS-62257

MANUAL 68P63010A79

stereo

MOTOROLA INC. 9401 WEST GRAND AVENUE, FRANKLIN PARK, ILLINOIS
PART NO. 68P63010A79 3-67 PRICE 65 CENTS
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MODEL NUMBER	SK 540C	SK 555C	SK 556C	SK 557C	SK 558C	SK 660C	SD 661C	SD 662C	SD 663C
CHANNELS	2	2	2	2	2	3	3	3	3
WATTS-MUSIC POWER OUTPUT	50	100	100	100	100	150	150	150	150
NUMBER OF SPEAKERS	6	6	6	6	6	6	6	6	6
SPEAKER COMPLEMENT	2-12" 2-6" Two H.T.	2-12" 2-6" Two H.T.	2-12" 2-6" Two H.T.	2-12" 2-6" Two H.T.	2-12" 2-6" Two H.T.	2-12" 2-8" Two H.T.	2-12" 2-8" Two H.T.	2-12" 2-8" Two H.T.	2-12" 2-8" Two H.T.
SEALED SOUND CHAMBERS		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
EXTERNAL SPEAKER PROVISIONS	Yes plus S.W.	Yes plus S.W.	Yes plus S.W.	Yes plus S.W.	Yes plus S.W.	Yes plus S.W.	Yes plus S.W.	Yes plus S.W.	Yes plus S.W.
TAPE RECORDER									
MOTOROLA 4-SPEED AUTOMATIC RECORD CHANGER	VM 122RC	VM 122RC	VM 122RC	VM 122RC	VM 122RC	VM 123RC	VM 123RC	VM 123RC	VM 123RC
CARTRIDGE	Solid State	Solid State	Solid State	Solid State	Solid State	Solid State	Solid State	Solid State	Solid State
STYLII	Dia.	Dia.	Dia.	Dia.	Dia.	Dia.	Dia.	Dia.	Dia.
CHANGER COMPARTMENT LIGHT	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
RECORD STORAGE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
OUTPUT STAGE	P.P.	P.P.	P.P.	P.P.	P.P.	P.P.	P.P.	P.P.	P.P.
LOUDNESS CONTROL	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
TONE CONTROL									
BASS AND TREBLE CONTROL	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
BALANCE CONTROL	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
TRANSFORMER POWER SUPPLY	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CIRCUIT PROTECTION	Cir. Guard	Cir. Guard	Cir. Guard	Cir. Guard	Cir. Guard	Cir. Guard	Cir. Guard	Cir. Guard	Cir. Guard
ON-OFF INDICATOR	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
STEREO HEADPHONE JACK	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
TAPE INPUT AND OUTPUT JACKS	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NOISE FILTER	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LOC/DIST. SWITCH	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
EXTENDED BASS	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FM MUTE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NUMBER OF TRANSISTORS	34	34	34	34	34	39	39	39	39
45 R.P.M. SPINDLE AND STORAGE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
TUNER CHASSIS	NCHS 62257	NCHS 62257	NCHS 62257	NCHS 62257	NCHS 62257	PCHS 62257	PCHS 62257	PCHS 62257	PCHS 62257
AMPLIFIER CHASSIS	HS 2338C	HS 62249	HS 62249	HS 62249	HS 62249	HS 2346B	HS 2346B	HS 2346B	HS 2346B
OTHER CHASSIS									
HEIGHT WIDTH (in inches) DEPTH	26" 56" 18-5/8	24-5/8" 60" 18½"	25" 64" 1·9"	24" 72" 19-5/8"	29·5/8" 56" 19·7/8"	24" 72" 18·5/8"	29¼" 60¾" 19·5/8"	30¼" 67" 19 5/8"	30¾" 66¼" 20¼"
MODEL NUMBER	SK 540C	SK 555C	SK 556C	SK 557C	SK 558C	SK 660C	SD 661C	SD 662C	SD 663C

CHASSIS CODING CHANGES

Chassis Coding	Chassis Coding Changes
NC & PCHS-62257A & B	ORIGINAL CHASSIS.
NC & PCHS-62257C	TO REDUCE HUM PICK-UP: Leads on extended base switch interchanged.
NC & PCHS-62257D	TO REDUCE HUM PICK-UP IN PHONO POSITION WITH STEREO LID CLOSED: Coupling capacitors, C-530 and C-531, were relocated below loudness control.
NC & PCHS-62257E	TO REDUCE TAPE PRE-AMP GAIN: Emitter resistors, R-503 and R-520, changed from 100 ohms to 680 ohms.
NC & PCHS-62257E-1	TO INCREASE HIGH FREQUENCY RESPONSE: Two .01 capacitors, C-536 and C-537 were added from high side of loudness control to 2nd top on loudness control. TO IMPROVE AGC PERFORMANCE: C-604 relocated from AGC line to collector of AGC amplifier, Q-602.
HS-2346B	ORIGINAL CHASSIS.
HS-2346C	TO MEET CSA (CANADIAN STANDARD ASSOCIATION) SPECIFICATIONS: R-60, 3.3M resistor added.
HS-2346D	TO PREVENT OSCILLATION IN BASE CHANNEL: Driver stage, R-61, 1K, resistor added.
HS-2346E	TO REDUCE BASS RESPONSE: C-7, .02 capacitor changed to .05.
HS-2346F	TO REDUCE BASE RESPONSE: R-62, 6.8K added.
HS-2338C	ORIGINAL CHASSIS.
HS-2338D	TO MEET CSA (CANADIAN STANDARD ASSOCIATION) SPECIFICATION: R-39, 3.3M resistor added.
HS-62249A	ORIGINAL CHASSIS.
HS-62249B	TO MEET CSA (CANADIAN STANDARD ASSOCIATION) SPECIFICATIONS: R-39, 3.3M resistor added.
HS-62249C	TO IMPROVE B+ REGULATION FOR TUNER: R-27 changed from 180 ohms to 120 ohms.

SERVICE NOTES

LINE CORD REVERSAL - For minimum hum, insert line cord plug in both positions. Leave it in the position that provides minimum hum.

OPERATING AMPLIFIER WITH LOAD - Always operate the amplifier with an output load (either speakers or resistors as indicated below).

HS-2338 chassis requires two 8 ohm, 25 watt resistors.

HS-62249 chassis requires two 8 ohm, 50 watt resistors.

HS-2346 chassis requires three 8 ohm, 50 watt resistors.

SPEAKER PHASING - The speakers must be in phase or a mid-range frequency loss may result. Speaker phasing can be checked by referring to the schematic diagram.

EXTENSION SPEAKER CONNECTIONS

Extension speakers can be easily connected to the speaker terminals on the back of the console as shown.

EXTERNAL TAPE

For external tape use, an audio amplifier stage has been added in each channel so that these units will readily adapt to the low or high impedance input of most tape recorders.

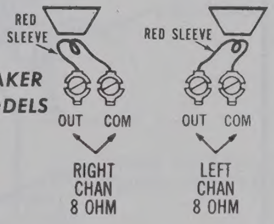
CARTRIDGE AND STYLI

Individual cartridges and styli are provided with the stereo consoles (Models SK660C, SD661C thru SD-663C). When playing stereo or monaural 16, 33 or 45 RPM records, use the cartridge and diamond stylus having a blue stripe on the cartridge housing.

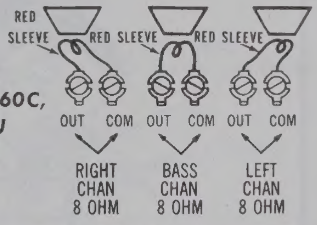
When playing 78RPM records, use the cartridge and stylus which has the number "78" marked on the top of the cartridge housing.

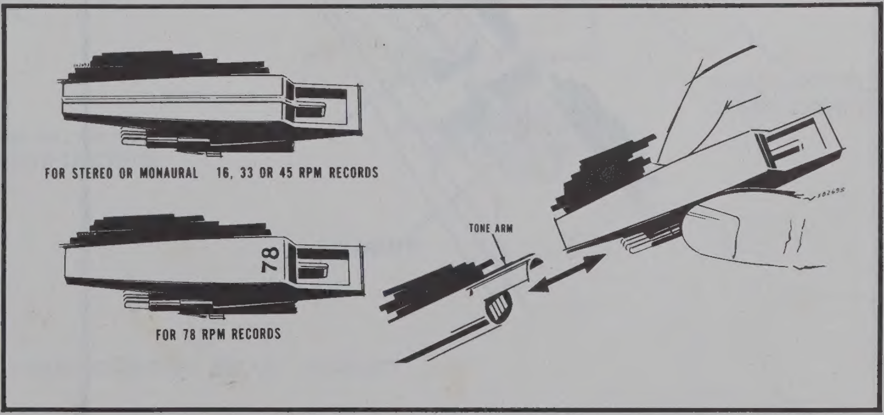
The cartridges can be easily changed by holding the tone arm and carefully pulling the cartridge out from the tone arm.

EXTENSION SPEAKER TERMINALS - MODELS SK540C, SK555C THRU SK558C



MODELS SK660C, SD661C THRU SD663C




FOR STEREO OR MONAURAL 16, 33 OR 45 RPM RECORDS
78
FOR 78 RPM RECORDS
TONE ARM

STYLUS REPLACEMENT (Models SK555C Thru SK558C)

To Remove Stylus

1. Position tone arm restriction clip to the open position (see illustration).

2. Lift tone arm to a vertical position and rotate the stylus selector to the 78RPM position.

3. Grasp stylus with fingers and with a gentle motion, twist stylus up so the tip end raises and the rear portion snaps out from under the retaining clip.

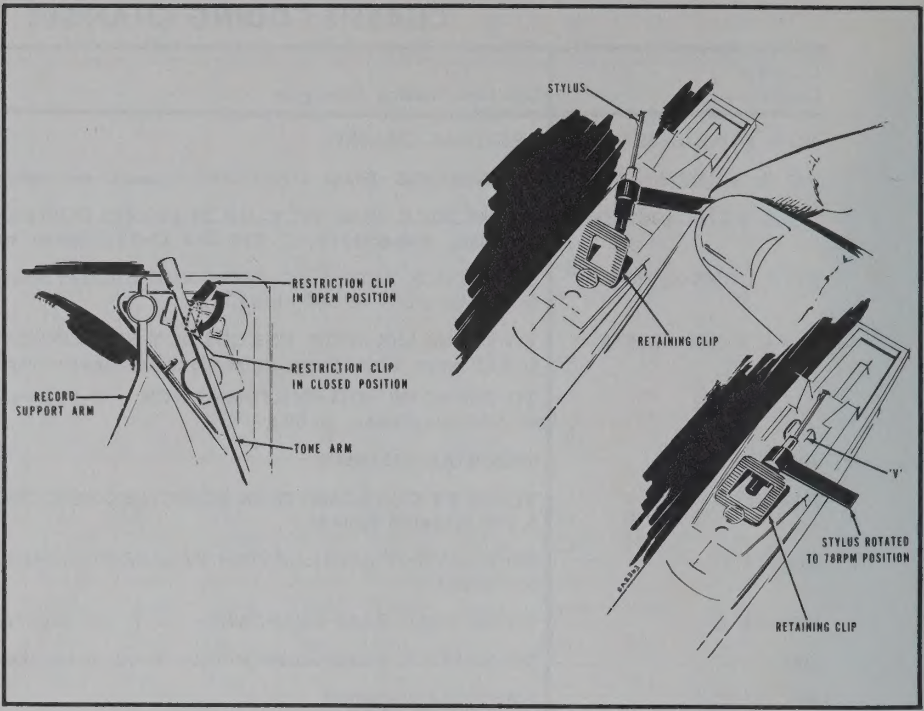
To Replace Stylus

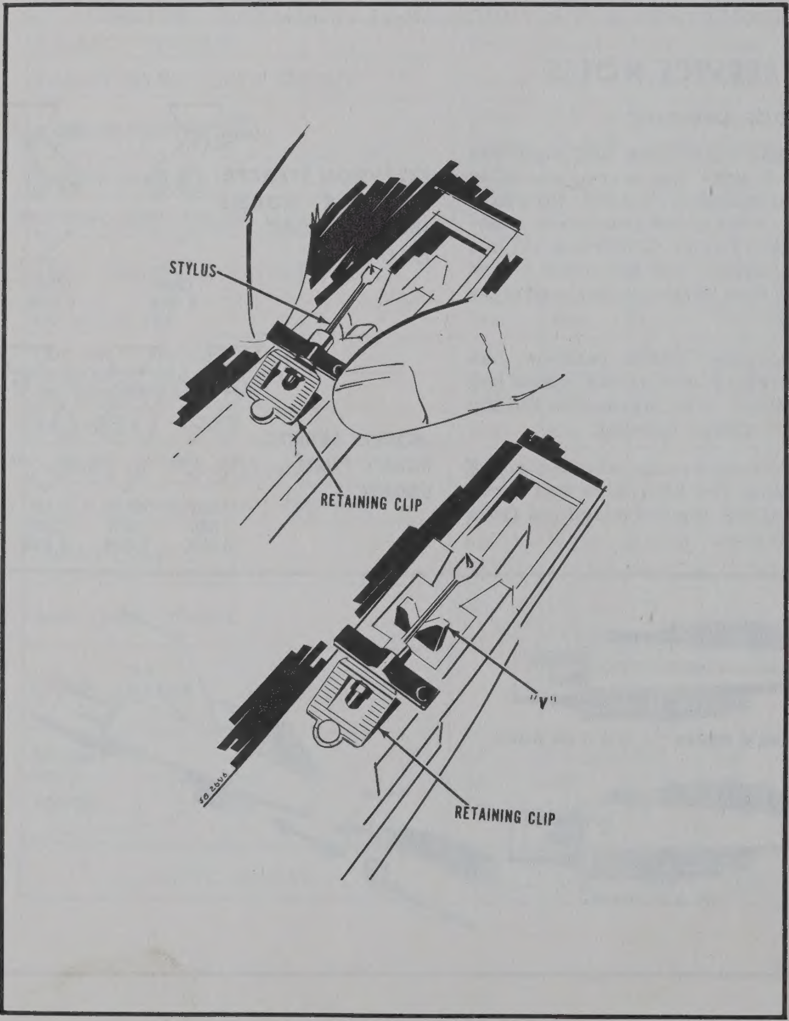
1. Check tone arm restriction clip; it should be in the open position. Then lift tone arm to a vertical position.

2. Holding new stylus in position with fingers, snap rear portion of stylus under the retaining clip.

3. Be sure stylus rests in "V" of cartridge; then return tone arm to normal position and place restriction clip in closed position.

REPLACEMENT STYLUS IS AVAILABLE UNDER THE FOLLOWING MOTOROLA PART NUMBER: 92-392DS.


STYLUS
RESTRICTION CLIP IN OPEN POSITION
RESTRICTION CLIP IN CLOSED POSITION
RECORD SUPPORT ARM
TONE ARM
RETAINING CLIP
'V'
STYLUS ROTATED TO 78RPM POSITION
RETAINING CLIP


STYLUS
RETAINING CLIP
"V"
RETAINING CLIP

STYLUS REPLACEMENT (Models SK660C, SD661C Thru SD663C)

To Remove Stylus

1. Position tone arm restriction clip to the open position; see illustration.

2. Lift tone arm to a vertical position.

3. Grasp stylus with fingers and with a gentle motion, lift stylus up so the tip end raises and the rear portion snaps out from under the retaining clip.

To Replace Stylus

1. Check tone arm restriction clip; it should be in the open position. Then lift tone arm to a vertical position.

2. Holding new stylus in position with fingers, snap rear portion of stylus under the retaining clip.

3. Be sure stylus rests in "V" of cartridge; then return tone arm to normal position and place restriction clip in closed position.

NOTE: The diamond stylus used with the cartridge for 16, 33 and 45 RPM records has a gold colored assembly. Replacement stylus may be purchased from your Motorola dealer under the following part number: 92-393D7.

The sapphire stylus used with the cartridge for 78 RPM records has a black colored assembly. Replacement stylus may be purchased from your Motorola dealer under part number: 92-393-53.

CHASSIS REMOVAL

Tuner Chassis Removal

1. Remove all seven (7) pushbuttons by pulling up from chassis.

2. Remove all four (4) control knobs in same manner.

3. Remove both dial control knobs from front of escutcheon.

4. Remove both cup nuts under dial knobs and one (1) screw in extreme left end of escutcheon.

5. Escutcheon may now be pulled away from tuner chassis, however, the tuning meter is still connected to the escutcheon. The tuning meter may now be separated from the escutcheon by removing the two (2) clips at the edges of the tuning meter mounting flange with a pair of long nosed pliers.

6. Unplug all plugs from bottom of tuner and remove AM and FM antenna leads from right end of tuner.

7. Remove the two (2) 1/4" hex bolts from the outermost edge of tuner chassis at the extreme right end of the chassis.

8. Remove the two (2) 5/16" nuts located at left end of chassis which secures chassis pan to tuner mounting bracket on lid. Remove 5/16" nut located above right end of AM-FM IF strip. Remove 5/16" nut located below bass and treble controls and lift chassis off.

Power Amplifier Removal

1. Remove AC line cord from AC outlet and remove cabinet back.

2. Remove all speaker leads from amplifier chassis.

3. Remove pilot light leads. Notice on Model SD661C chassis must be removed before pilot light leads may be unplugged.

4. Remove power and audio plugs from chassis.

5. Remove four (4) 5/16" hex head bolts from outer flange of chassis and lift chassis out.

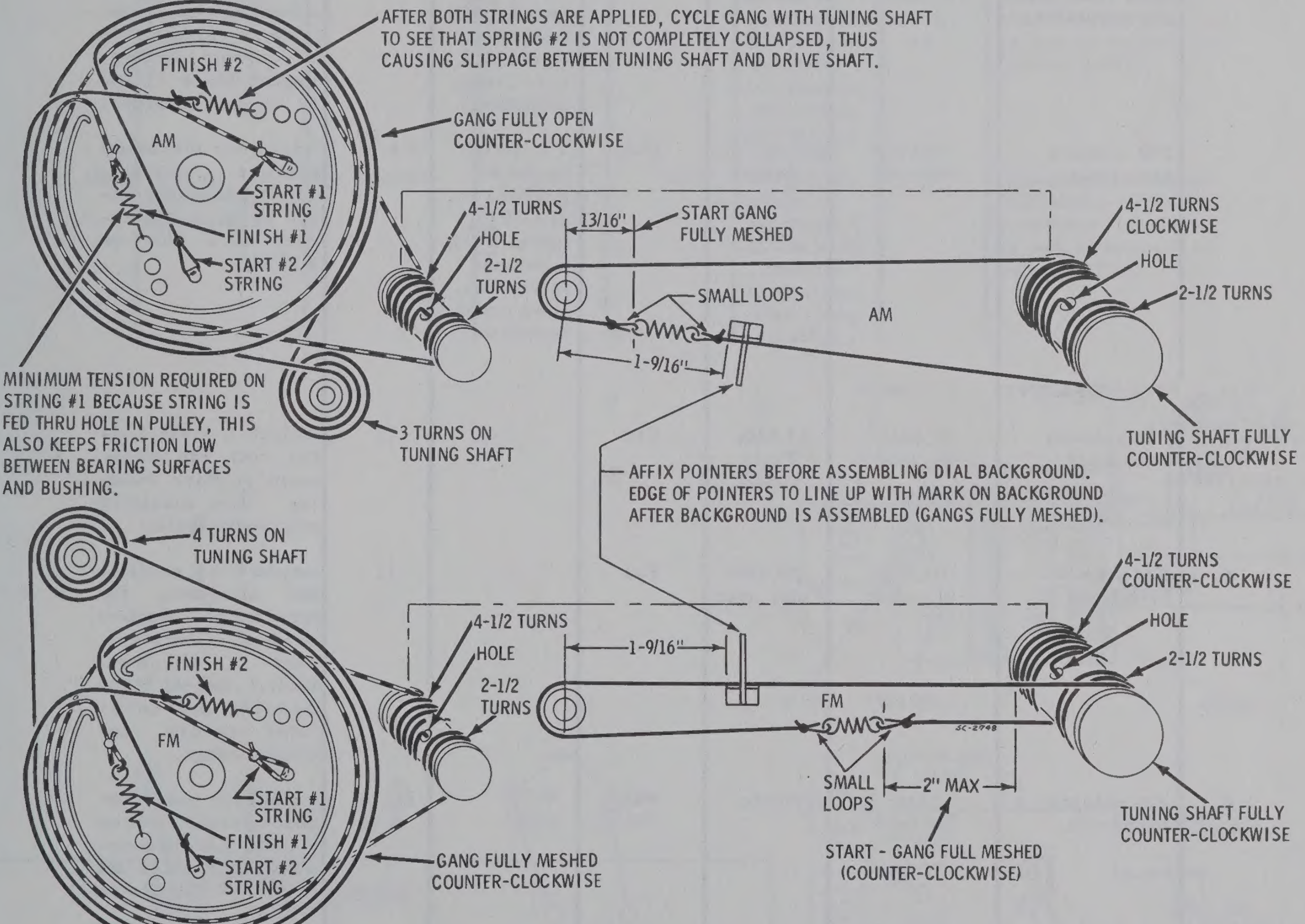
CHANGER REMOVAL

1. Remove back.

2. Screw changer hold down screw (clockwise) fully into changer base.

3. Position retaining clips in a vertical plane.

4. Disconnect audio and power cables; lift up changer base.


AFTER BOTH STRINGS ARE APPLIED, CYCLE GANG WITH TUNING SHAFT TO SEE THAT SPRING #2 IS NOT COMPLETELY COLLAPSED, THUS CAUSING SLIPPAGE BETWEEN TUNING SHAFT AND DRIVE SHAFT.
FINISH #2
AM
GANG FULLY OPEN COUNTER-CLOCKWISE
START #1 STRING
FINISH #1
START #2 STRING
4-1/2 TURNS
HOLE
2-1/2 TURNS
13/16"
START GANG FULLY MESHED
SMALL LOOPS
AM
1-9/16"
4-1/2 TURNS CLOCKWISE
HOLE
2-1/2 TURNS
TUNING SHAFT FULLY COUNTER-CLOCKWISE
MINIMUM TENSION REQUIRED ON STRING #1 BECAUSE STRING IS FED THRU HOLE IN PULLEY, THIS ALSO KEEPS FRICTION LOW BETWEEN BEARING SURFACES AND BUSHING.
3 TURNS ON TUNING SHAFT
AFFIX POINTERS BEFORE ASSEMBLING DIAL BACKGROUND. EDGE OF POINTERS TO LINE UP WITH MARK ON BACKGROUND AFTER BACKGROUND IS ASSEMBLED (GANGS FULLY MESHED).
4 TURNS ON TUNING SHAFT
4-1/2 TURNS COUNTER-CLOCKWISE
HOLE
2-1/2 TURNS
FINISH #2
4-1/2 TURNS
HOLE
2-1/2 TURNS
1-9/16"
FM
FM
SC-2748
START #1 STRING
FINISH #1
START #2 STRING
SMALL LOOPS
2" MAX
GANG FULLY MESHED COUNTER-CLOCKWISE
START - GANG FULL MESHED (COUNTER-CLOCKWISE)
TUNING SHAFT FULLY COUNTER-CLOCKWISE

DIAL STRINGING DETAIL - HS-62257

ALIGNMENT - CHASSIS HS-62257

FM-AM ALIGNMENT

PRELIMINARY PROCEDURE

Either AM or FM alignment may be performed independently of the other. Use an AM signal generator and a VTVM as indicated. Use insulated alignment tools. When aligning the AM or FM IF stages, load the signal generator by placing a 1 ohm resistor across its output terminals. As stages are brought into alignment, keep reducing signal generator output so meter reads no more than 2 volts DC for FM and 1 volt DC for AM. In AM alignment, signal generator should be modulated with 400CPS and AM dummy antenna connected as shown in Figure #1. Place mute switch in off position.

STEP	GENERATOR CONNECTION	GENERATOR FREQUENCY	GANG SETTING	BAND SW SETTING	OUTPUT INDICATOR	ADJUST	REMARKS
FM - IF ALIGNMENT							
1.	Base of Q-8 1st FM IF thru .01 capacitor.	10.7Mc No mod	108.5Mc Fully open	FM	VTVM DC probe to positive end of C-69 (point $\boxed{A}$). Common to chassis. (Use 1 meg, isolation.)	1, 2, 3, 4, 5, 6 & 7	Adjust for maximum positive indication on VTVM. Limit generator output so as not to exceed 2.0 volts on VTVM.
2.	Base of Q-4 1st FM IF thru .01 capacitor.	10.7Mc No mod	108.5Mc Fully open	FM	VTVM zero center (point $\boxed{B}$). Common to chassis. (Use 1 meg, isolation.)	10	Adjust for zero reading on VTVM. A + or - reading will be obtained on either side of correct setting. Repeat Steps #1 and #2 in same order.
3.	FM antenna terminals.	98Mc No mod	Set dial to 98Mc	FM	VTVM DC probe to positive end of C-69 (point $\boxed{A}$). Common to chassis. (Use 1 meg, isolation.)	8 & 9	Adjust for maximum positive reading. Limit generator input so as not to exceed +2.0 volt on VTVM.
FM - RF ALIGNMENT							
4.	FM antenna terminals.	87.5Mc No mod	87.5Mc Fully closed	FM	"	12	Adjust L-7, oscillator coil, for maximum positive reading. (Use insulated alignment tools.)
5.	FM antenna terminals.	108.5Mc No mod	108.5Mc Fully open	FM	"	11	Adjust C-15, oscillator trimmer, for maximum positive reading. (Use insulated alignment tools.) Repeat Steps #4 and #5 until oscillator covers required range.
6.	FM antenna terminals.	90Mc No mod	90Mc	FM	"	13, 14 & 15	Adjust for maximum positive indication on VTVM. Limit generator output so as not to exceed 2.0 volts on VTVM.
7.	FM antenna terminals.	104Mc No mod	104Mc	FM	"	16, 17 & 18	Adjust for maximum positive indication on VTVM. Limit generator output so as not to exceed 2.0 volts on VTVM.

STEP	GENERATOR CONNECTION	GENERATOR FREQUENCY	GANG SETTING	BAND SW SETTING	OUTPUT INDICATOR	ADJUST	REMARKS
FM MUTE ADJUSTMENT							
8.	FM antenna terminals.	98Mc (400CPS modulation)	Set dial to 98Mc	FM	Scope	35	Set generator output to 10 uv. Place mute switch to "ON" position. Rotate control maximum clockwise. Turn control counter-clockwise until undistorted output appears on scope.
	Alternate Mute Adjustment						
	---	---	Tune dial to quiet spot on band (between stations).	FM	---	35	Place mute switch to "ON" position. Rotate control maximum clockwise. Turn control counter-clockwise until background noise just disappears.
AM - IF ALIGNMENT							
9.	Base of Q-6 (AM mixer) thru .01mf capacitor.	455Kc	Fully open	AM	VTVM DC probe to junction of E-7 & R-65. Common to chassis. (Use 1 meg isolation.)	19, 20, 21, 22, 23 & 24	Adjust for maximum indication. Maintain generator output so as not to exceed .05 volt on VTVM.
10.	Dummy antenna (see Figure #1).	532Kc	Fully closed	AM	VTVM DC probe to junction of E-7 & R-65. Common to chassis. (Use 1 meg isolation.)	25	Adjust for maximum indication. Maintain generator output so as not to exceed .05 volt on VTVM.

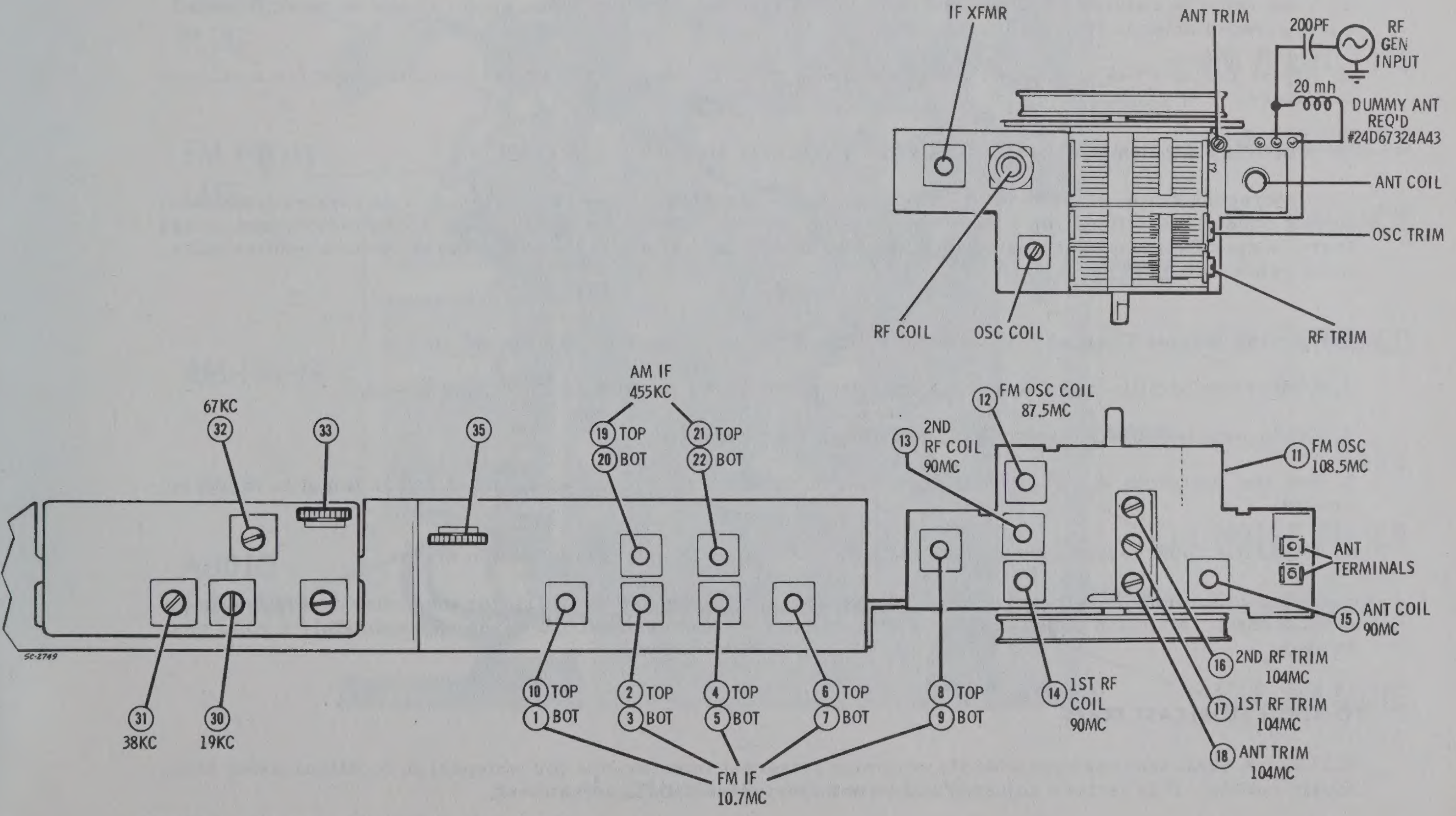

IF XFMR
ANT TRIM
200PF
RF GEN INPUT
20 mh
DUMMY ANT REQ'D #24D67324A43
ANT COIL
OSC TRIM
RF COIL
OSC COIL
RF TRIM
AM IF 455KC
67KC
32
33
35
19 TOP
20 BOT
21 TOP
22 BOT
12 FM OSC COIL 87.5MC
13 2ND RF COIL 90MC
11 FM OSC 108.5MC
ANT TERMINALS
15 ANT COIL 90MC
16 2ND RF TRIM 104MC
17 1ST RF TRIM 104MC
18 ANT TRIM 104MC
14 1ST RF COIL 90MC
31 38KC
30 19KC
10 TOP
1 BOT
2 TOP
3 BOT
4 TOP
5 BOT
6 TOP
7 BOT
8 TOP
9 BOT
FM IF 10.7MC
SC-2749

FIGURE 1 - FM-AM ALIGNMENT LOCATION

STEP	GENERATOR CONNECTION	GENERATOR FREQUENCY	GANG SETTING	BAND SW SETTING	OUTPUT INDICATOR	ADJUST	REMARKS
11.	"	1620Kc	Fully open	AM	"	26	Adjust for maximum indication. Maintain generator output so as not to exceed .05 volt on VTVM. Repeat Steps #9 and #10 until oscillator covers required range.
12.	"	600Kc	600Kc	AM	"	27	Adjust for maximum indication. Maintain generator output so as not to exceed .05 volt on VTVM. Repeat Steps #9 and #10 until oscillator covers required range.
13.	"	1400Kc	1400Kc	AM	"	28 & 29	Adjust for maximum indication. Maintain generator output so as not to exceed .05 volt on VTVM. Repeat Steps #9 and #10 until oscillator covers required range.

FM STEREO ALIGNMENT PROCEDURE

NOTE: Motorola FM stereo units are factory aligned and have been found to be extremely stable under shipping and handling conditions. Alignment is not required as a part of the normal installation procedure.

FM MULTIPLEX ALIGNMENT USING AN FM-STEREO STATION AIR SIGNAL

NOTE: Storecast traps cannot be easily aligned using an air signal. A generator should be used for trap alignment.

19Kc Pilot Carrier Channel Alignment And 38Kc Frequency Doubler Adjustment

1. Tune radio to a stereo FM broadcast. For best alignment conditions, the signal should be weak; if necessary, remove antenna twin lead from tuner.

2. Adjust L-8 and T-6 (alignment points #30 and #30) while viewing the stereo indicator light for maximum brilliance.

FM MULTIPLEX ALIGNMENT USING MOTOROLA STEREO-FM ALIGNER

The storecast traps provide attenuation in excess of 40 db at the 67Kc storecast sub-carrier frequency. Under normal conditions, they should require no service. They are carefully set at the factory and unless there is specific complaint of storecast interference, it is best not to include these traps in a routine alignment procedure.

19Kc Pilot Carrier Channel Alignment And 38Kc Frequency Doubler Adjustment

1. Connect an oscilliscope using a low capacity probe to the junction of E-301 and E-302.

2. Disconnect the lead between C-302 and R-219 (test point $\boxed{B}$).

3. Set the Motorola Stereo-FM Aligner to 19Kc and connect to the open end of C-302 (input to multiplex circuit).

4. Connect a 100K resistor from B+ to the cathode of diode E-602 (pilot squelch diode).

5. Tune coil, L-8, and transformer, T-6 (alignment points #30 and #31), for maximum indication on the oscilliscope. Maintain output level of stereo aligner so that oscilliscope reads approximately 4 volts peak to peak.

TO ALIGN STORECAST TRAPS

NOTE: A 53Mc trap has been added to minimize storecast interference (or whisper) in locations using store music outlets. It is factory adjusted and is not considered a field adjustment.

1. Connect an oscilliscope using a low capacity probe to the junction of E-301 and E-302.

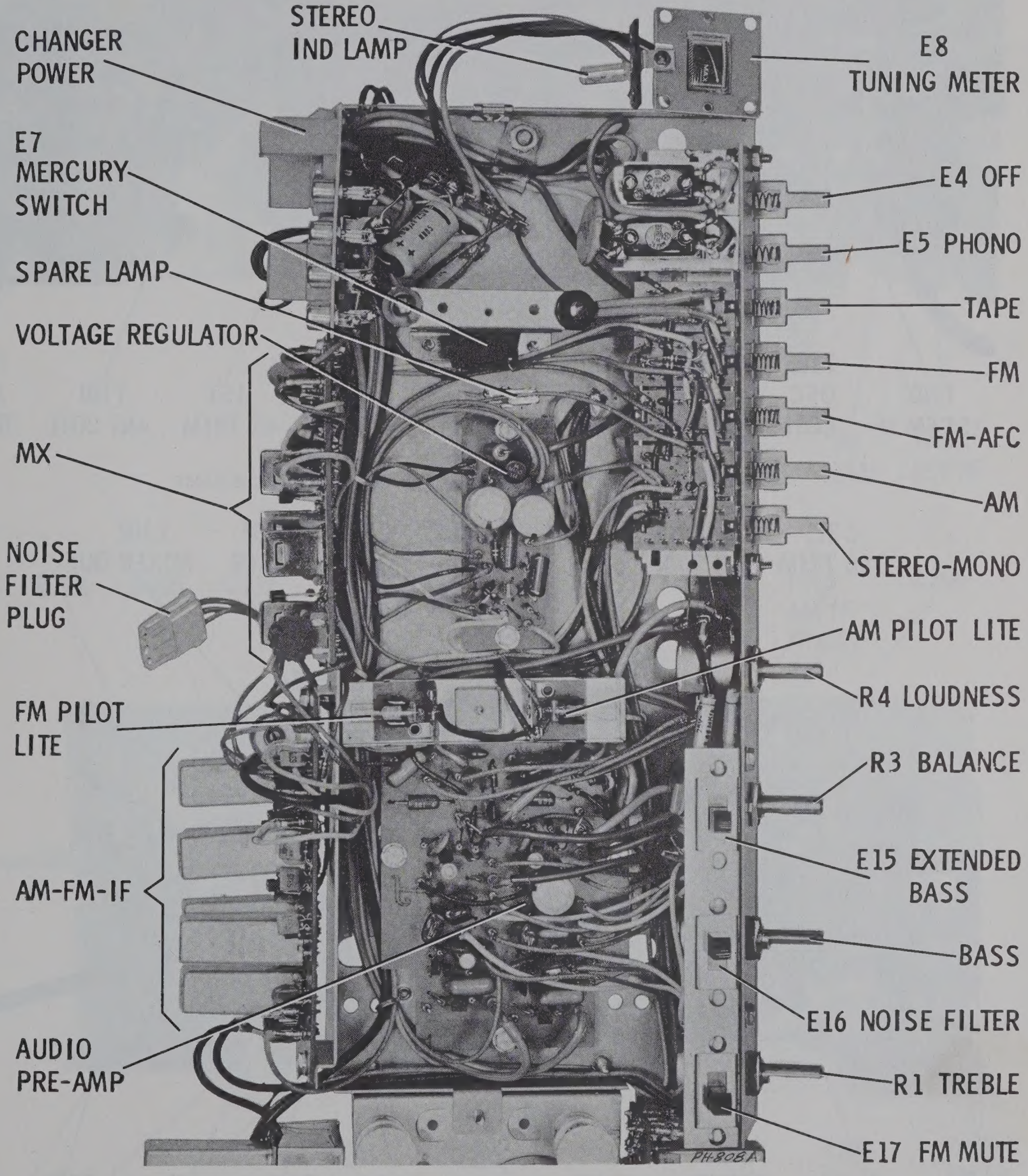
2. Disconnect the lead between C-302 and R-219 (test point $\boxed{B}$).

3. Set the Motorola Stereo-FM Aligner to SCA and connect to the open end of C-302 (input to multiplex circuit).

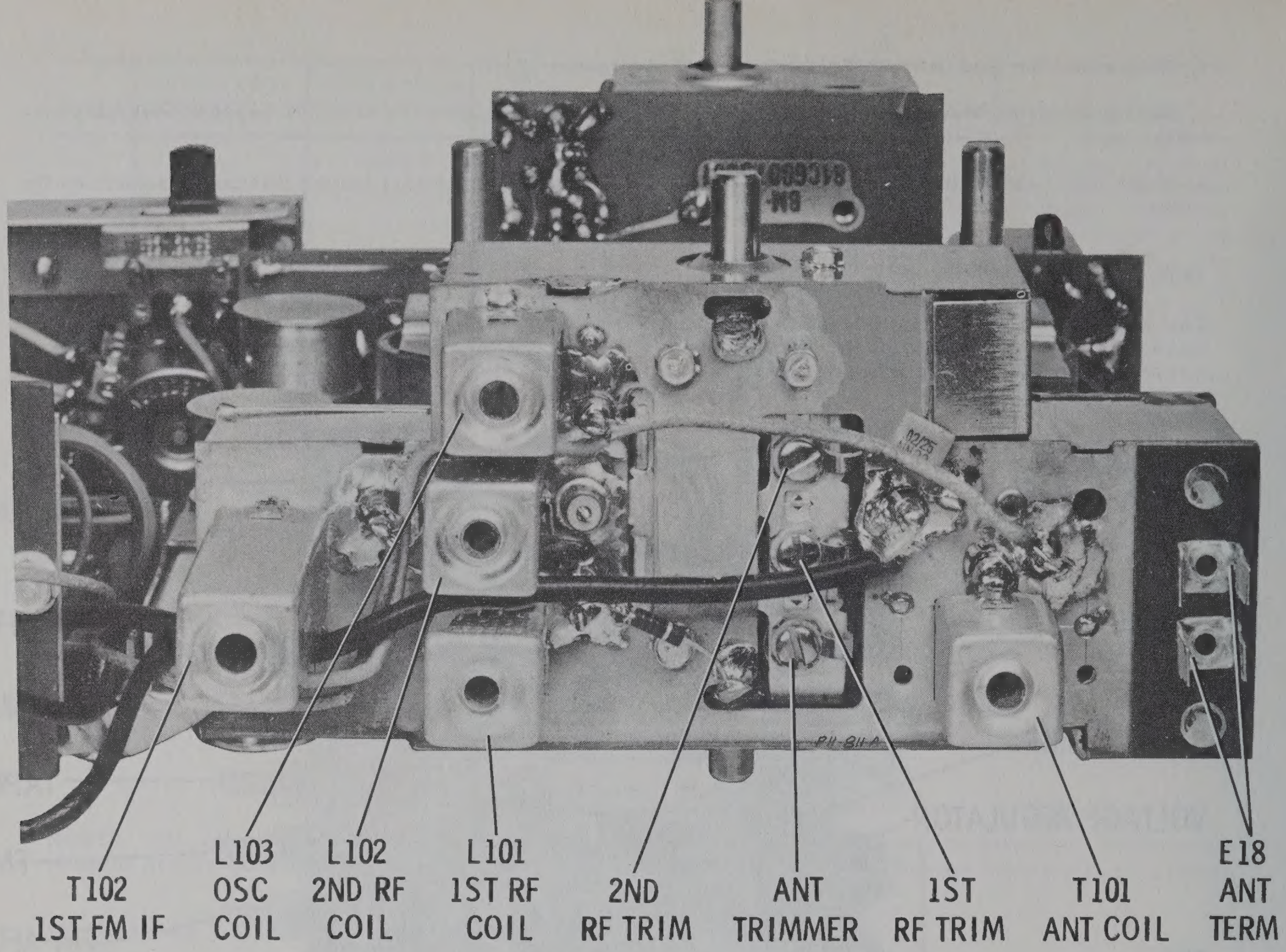
4. Short out L-301 with a jumper and adjust L-302 (alignment point #32) for a minimum indication on the scope.

19KC GAIN ADJUSTMENT

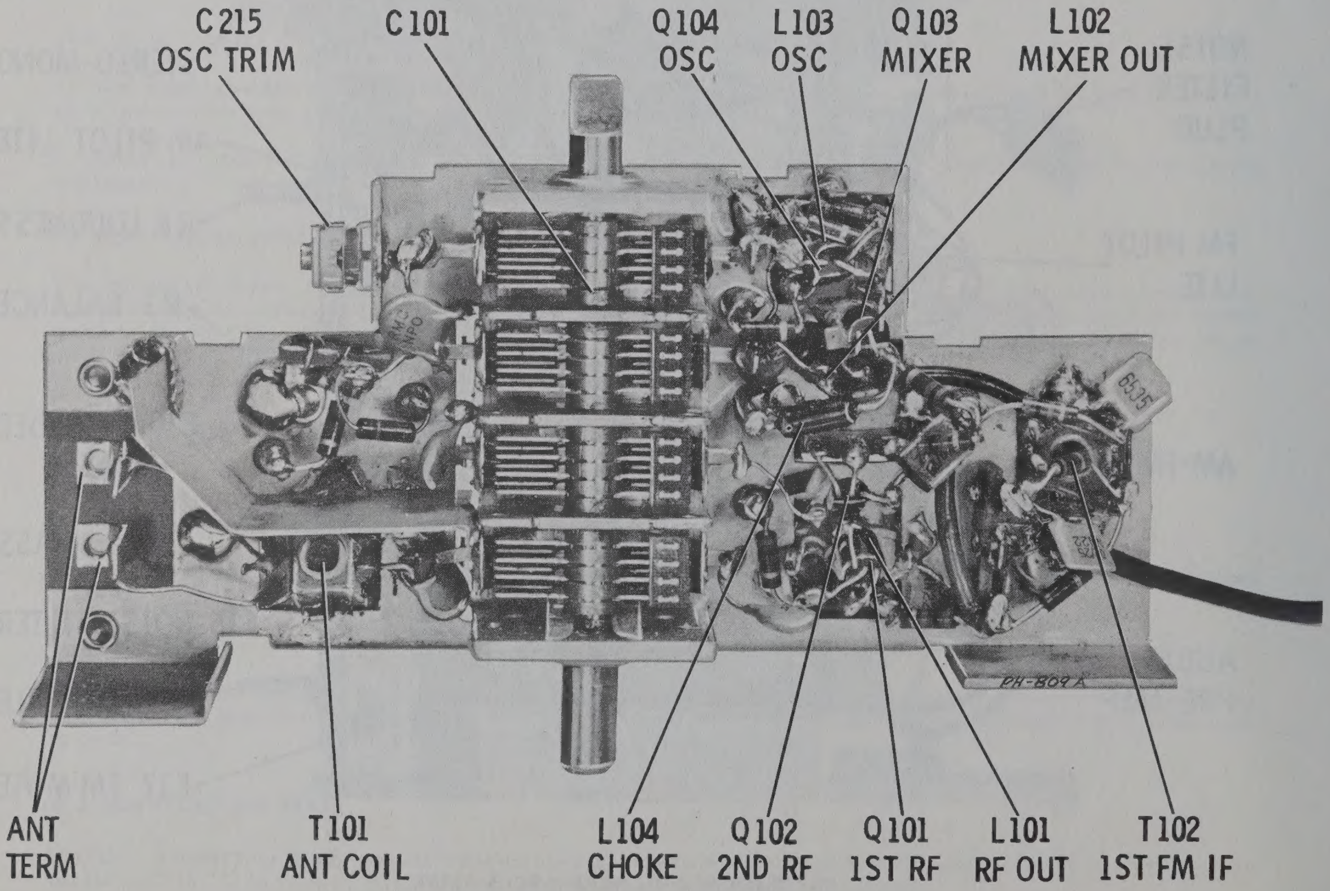
The 19Kc gain adjustment, R-5 (alignment point #33), is pre-set by the factory and normally does not require adjustment. However, if the stereo indicator lamp glows very dim on a stereo broadcast, the control can be advanced clockwise a few degrees.


STEREO IND LAMP
CHANGER POWER
E8 TUNING METER
E7 MERCURY SWITCH
E4 OFF
E5 PHONO
SPARE LAMP
TAPE
VOLTAGE REGULATOR
FM
FM-AFC
MX
AM
NOISE FILTER PLUG
STEREO-MONO
AM PILOT LITE
R4 LOUDNESS
FM PILOT LITE
R3 BALANCE
E15 EXTENDED BASS
AM-FM-IF
BASS
E16 NOISE FILTER
AUDIO PRE-AMP
R1 TREBLE
E17 FM MUTE
PH-808A

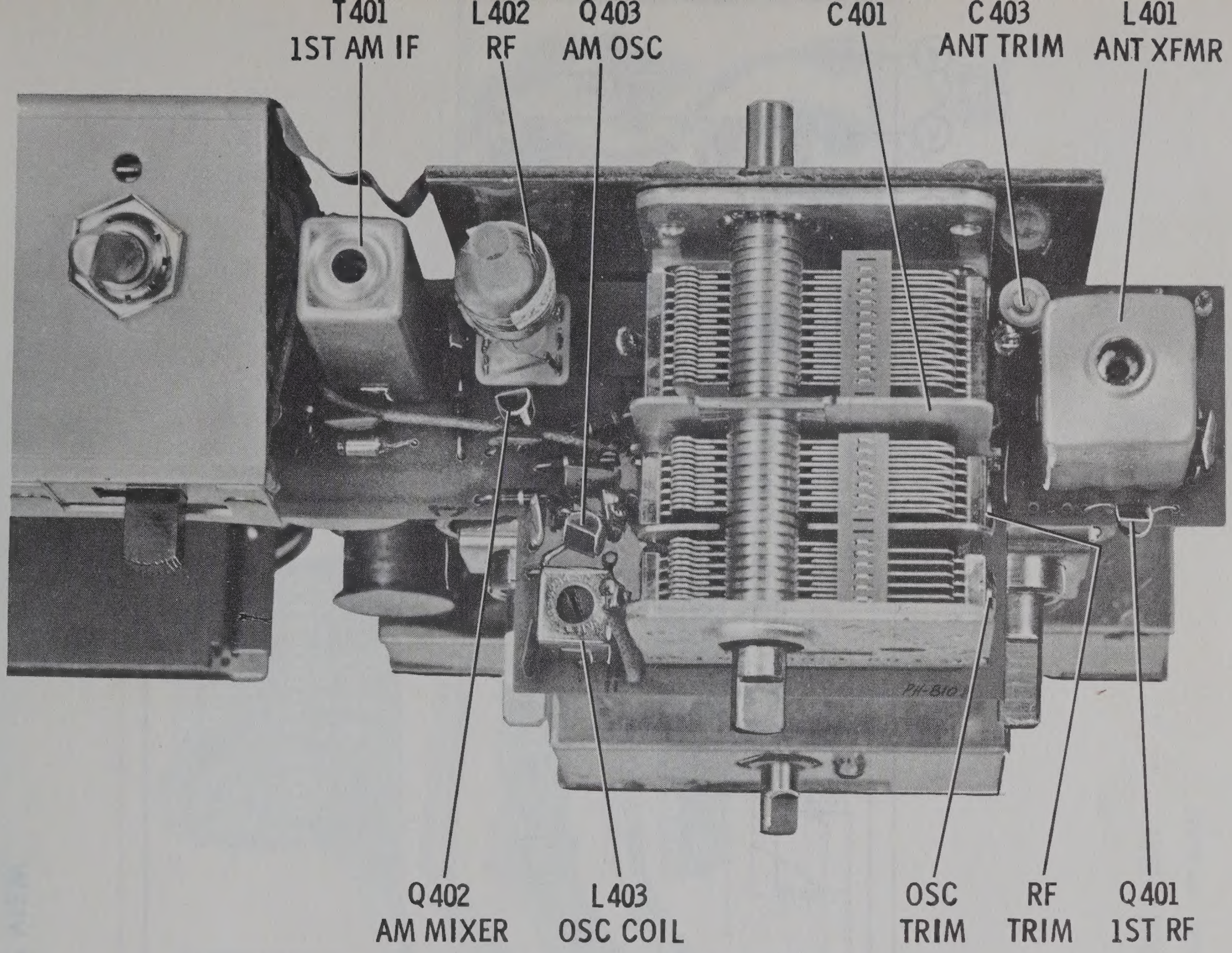
PARTS LOCATION - NCHS & PCHS-62257


PH-811 A
T102
1ST FM IF
L103
OSC
COIL
L102
2ND RF
COIL
L101
1ST RF
COIL
2ND
RF TRIM
ANT
TRIMMER
1ST
RF TRIM
T101
ANT COIL
E18
ANT
TERM

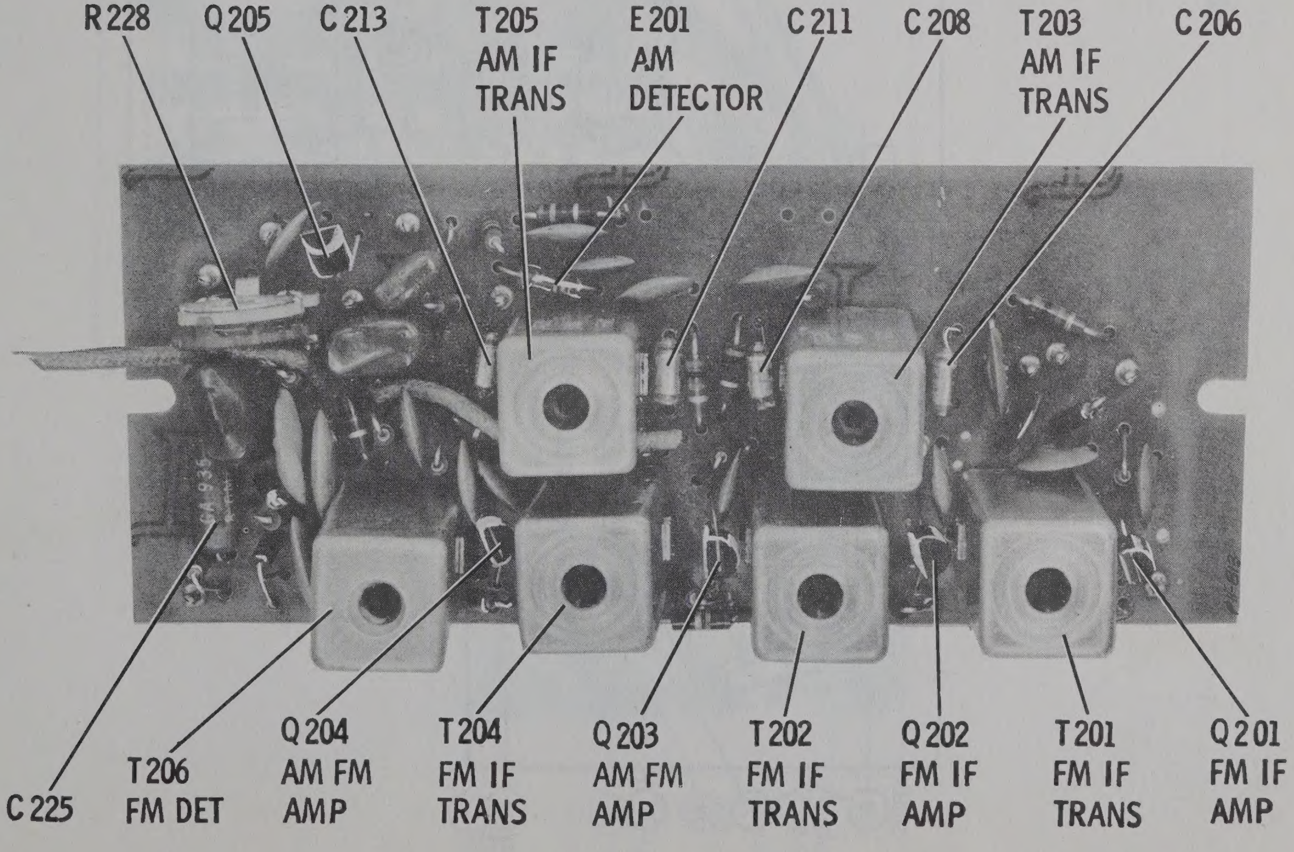
FM RF SECTION PARTS LOCATION (TOP VIEW) - NCHS & PCHS-62257


C215
OSC TRIM
C101
Q104
OSC
L103
OSC
Q103
MIXER
L102
MIXER OUT
PH-809 A
ANT
TERM
T101
ANT COIL
L104
CHOKE
Q102
2ND RF
Q101
1ST RF
L101
RF OUT
T102
1ST FM IF

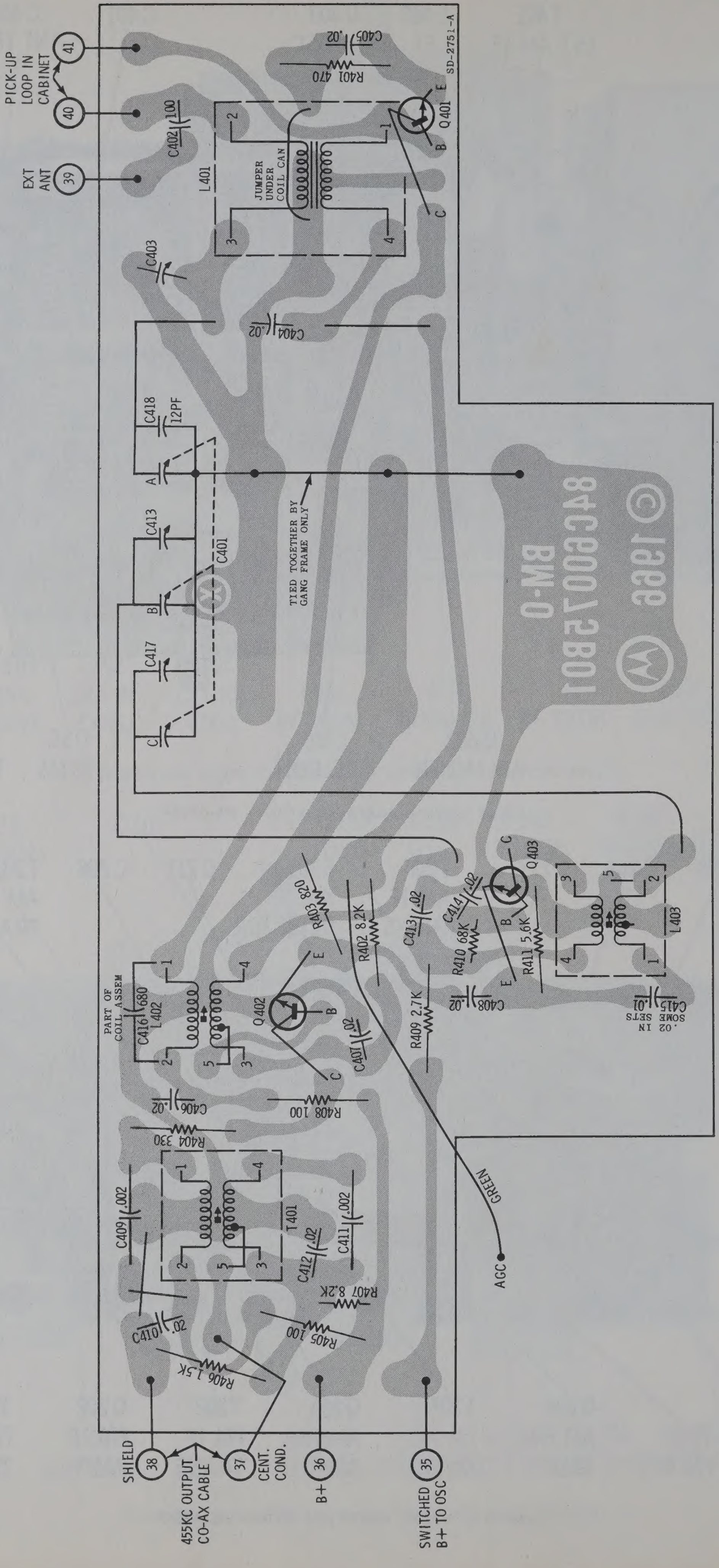
FM RF SECTION PARTS LOCATION (BOTTOM VIEW) - HS-62257


T401
1ST AM IF
L402
RF
Q403
AM OSC
C401
C403
ANT TRIM
L401
ANT XFMR
PH-B10
Q402
AM MIXER
L403
OSC COIL
OSC
TRIM
RF
TRIM
Q401
1ST RF

AM RF SECTION PARTS LOCATION - HS-62257


R228
Q205
C213
T205
AM IF
TRANS
E201
AM
DETECTOR
C211
C208
T203
AM IF
TRANS
C206
C225
T206
FM DET
Q204
AM FM
AMP
T204
FM IF
TRANS
Q203
AM FM
AMP
T202
FM IF
TRANS
Q202
FM IF
AMP
T201
FM IF
TRANS
Q201
FM IF
AMP

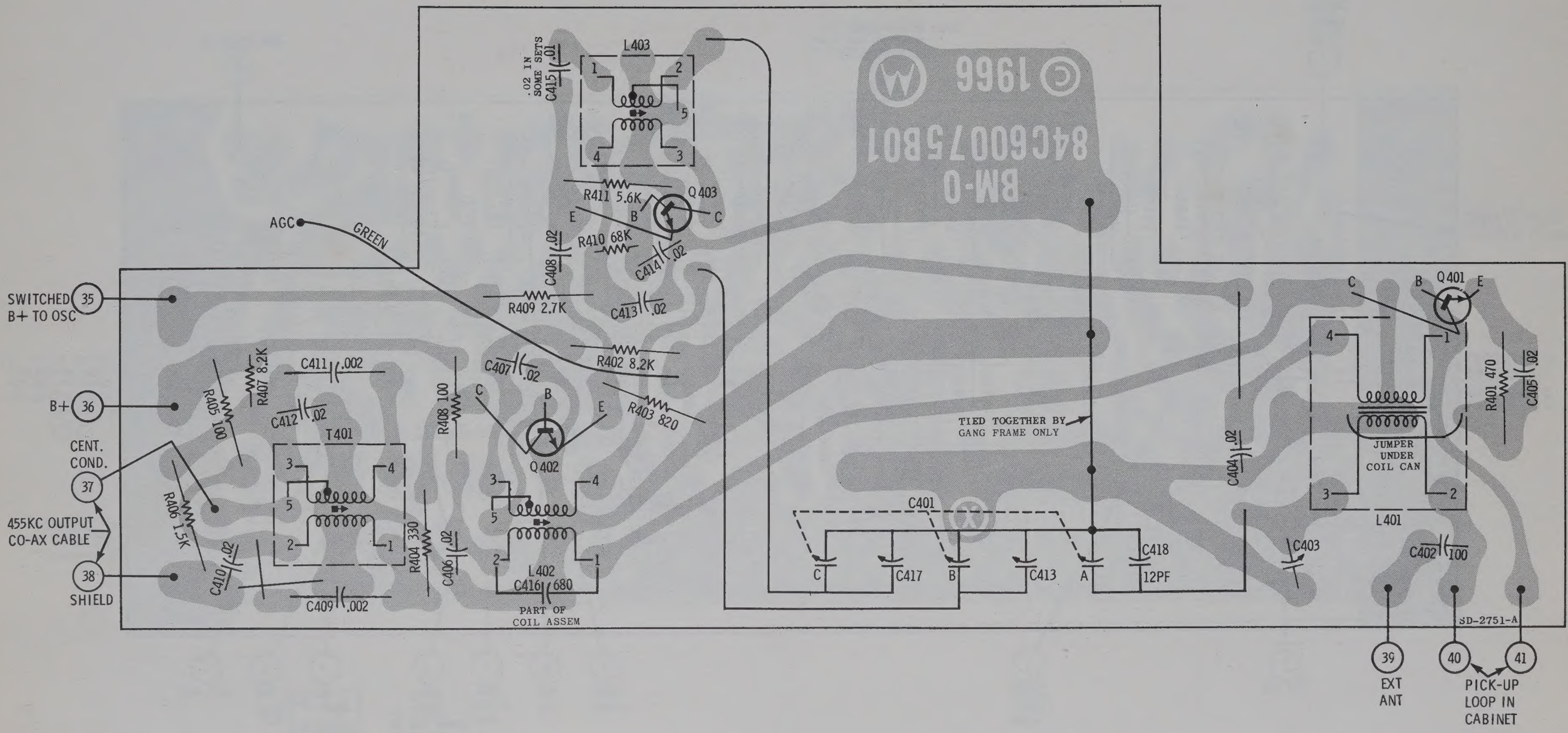
AM-FM IF BOARD PARTS LOCATION - HS-62257



SD-2751-A
PICK-UP LOOP IN CABINET
41
40
EXT ANT
39
C405 .02
R401 470
C402 100
L401
JUMPER UNDER COIL CAN
1
2
3
4
Q401
E
B
C
C403
C404 .02
C418 12PF
A
C413
C401
B
C417
C
TIED TOGETHER BY GANG FRAME ONLY
PART OF COIL ASSEM
C416 680
L402
5
Q402
R403 820
R402 8.2K
C407 .02
R409 2.7K
C413 .02
C414 .02
Q403
R410 68K
R411 5.6K
C408 .02
L403
C415 .01
.02 IN SOME SETS
C406 .02
R408 100
R404 330
T401
C409 .002
C411 .002
C412 .02
R407 8.2K
R405 100
C410 .02
R406 1.5K
GREEN
AGC
SHIELD
38
455KC OUTPUT CO-AX CABLE
37
CENT. COND.
36
B+
35
SWITCHED B+ TO OSC

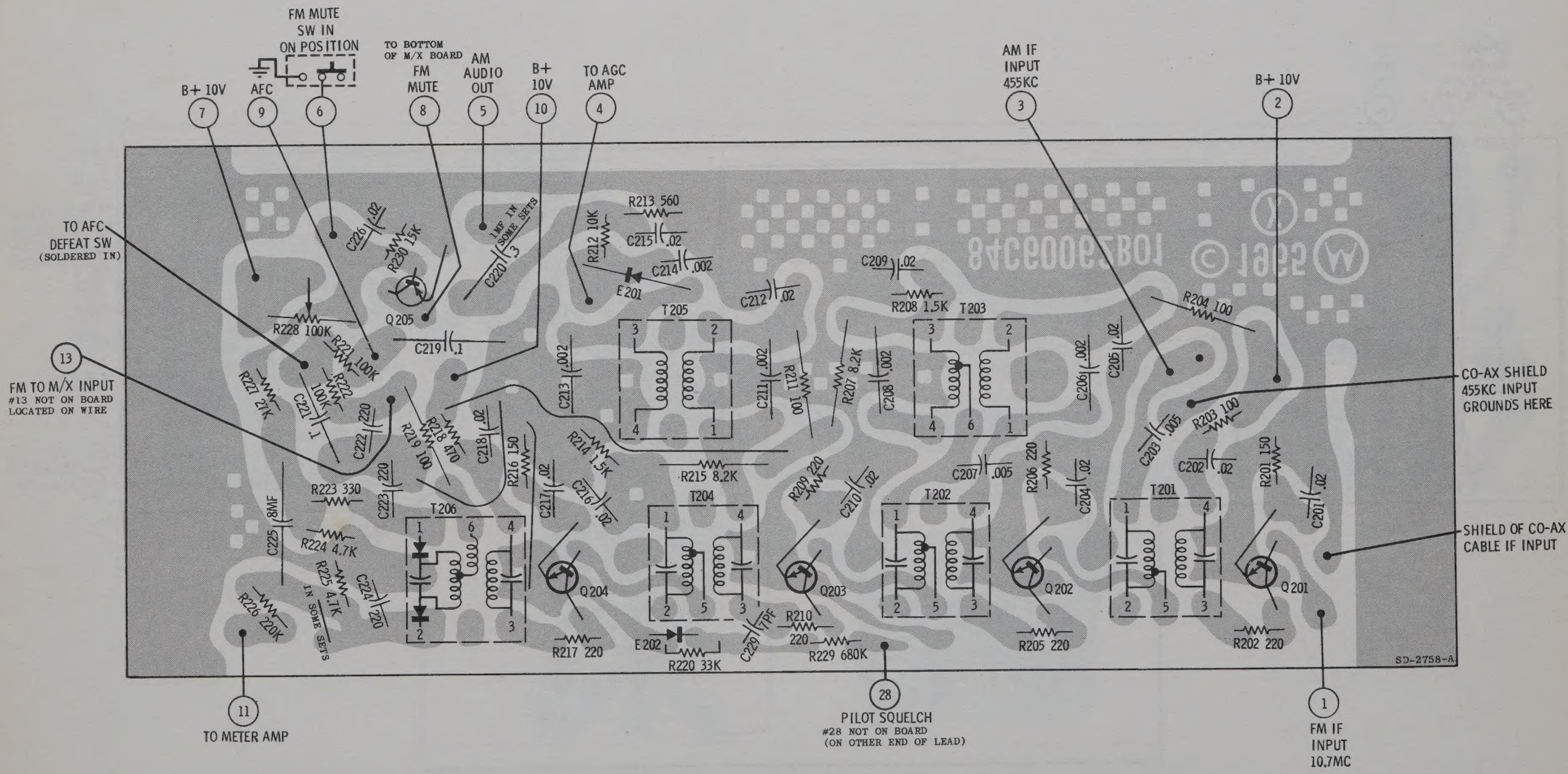
TOP VIEW

AM RF BOARD - HS-62257


L403
1
2
5
4
3
.02 IN SOME SETS
C415 .01
R411 5.6K
Q403
E
B
C
AGC
GREEN
C408 .02
R410 68K
C414 .02
SWITCHED B+ TO OSC
35
R409 2.7K
C413 .02
C411 .002
R407 8.2K
C407 .02
R402 8.2K
B+
36
R405 100
C412 .02
R408 100
C
B
E
R403 820
T401
CENT. COND.
37
3
4
5
2
1
Q402
3
4
5
2
1
R406 1.5K
455KC OUTPUT CO-AX CABLE
R404 330
C406 .02
L402
C416 680
PART OF COIL ASSEM
38
SHIELD
C410 .02
C409 .002
BM-0
84C60075B01
© 1966
TIED TOGETHER BY GANG FRAME ONLY
C401
C
C417
B
C413
A
C418
12PF
C404 .02
C403
Q401
C
B
E
4
1
3
2
JUMPER UNDER COIL CAN
L401
R401 470
C405 .02
C402 100
SD-2751-A
39
EXT ANT
40
41
PICK-UP LOOP IN CABINET

BOTTOM VIEW

AM RF BOARD - HS-62257


FM MUTE SW IN ON POSITION
TO BOTTOM OF M/X BOARD
B+ 10V
AFC
FM MUTE
AM AUDIO OUT
B+ 10V
TO AGC AMP
AM IF INPUT 455KC
B+ 10V
TO AFC DEFEAT SW (SOLDERED IN)
FM TO M/X INPUT
#13 NOT ON BOARD LOCATED ON WIRE
CO-AX SHIELD 455KC INPUT GROUNDS HERE
SHIELD OF CO-AX CABLE IF INPUT
TO METER AMP
PILOT SQUELCH
#28 NOT ON BOARD (ON OTHER END OF LEAD)
FM IF INPUT 10.7MC
SD-2758-A
1 2 3 4 5 6 7 8 9 10 11 13 28
R201 150
R202 220
R203 100
R204 100
R205 220
R206 220
R207 8.2K
R208 1.5K
R209 220
R210 220
R211 100
R212 10K
R213 560
R214 1.5K
R215 8.2K
R216 150
R217 220
R218 470
R219 100
R220 33K
R221 100K
R222 100K
R223 330
R224 4.7K
R225 4.7K
IN SOME SETS
R226 220K
R227 27K
R228 100K
R229 680K
R230 15K
C201 .02
C202 .02
C203 .005
C205 .02
C206 .002
C204 .02
C207 .005
C208 .002
C209 .02
C210 .02
C211 .002
C212 .02
C213 .002
C214 .002
C215 .02
C216 .02
C217 .02
C218 .02
C219 .1
C220 3
1MF IN SOME SETS
C221 .1
C222 220
C223 220
C224 220
C225 8MF
C226 .02
C229 7PF
T201 T202 T203 T204 T205 T206
Q201 Q202 Q203 Q204 Q205
E201 E202
84C690027B01
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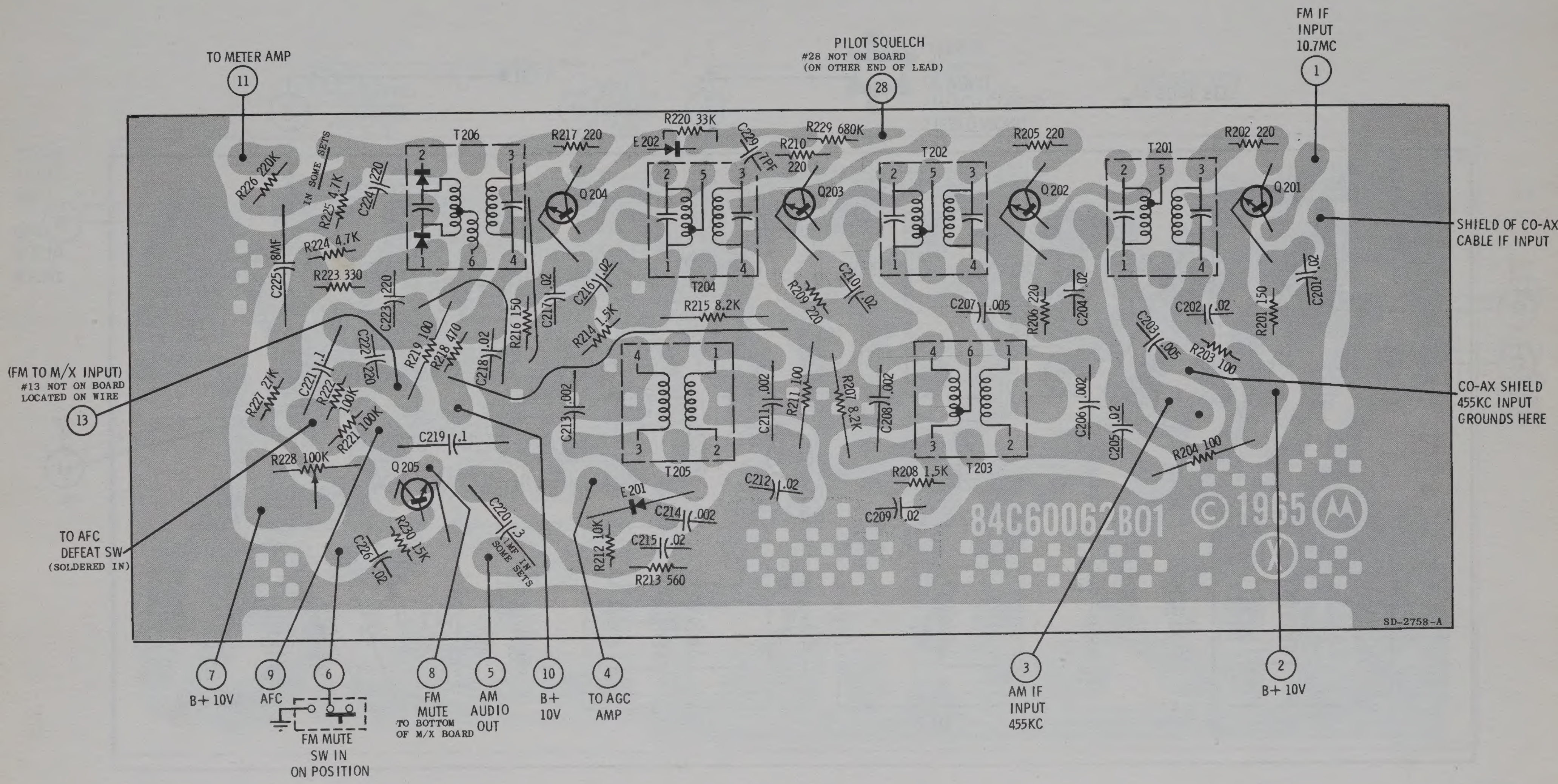
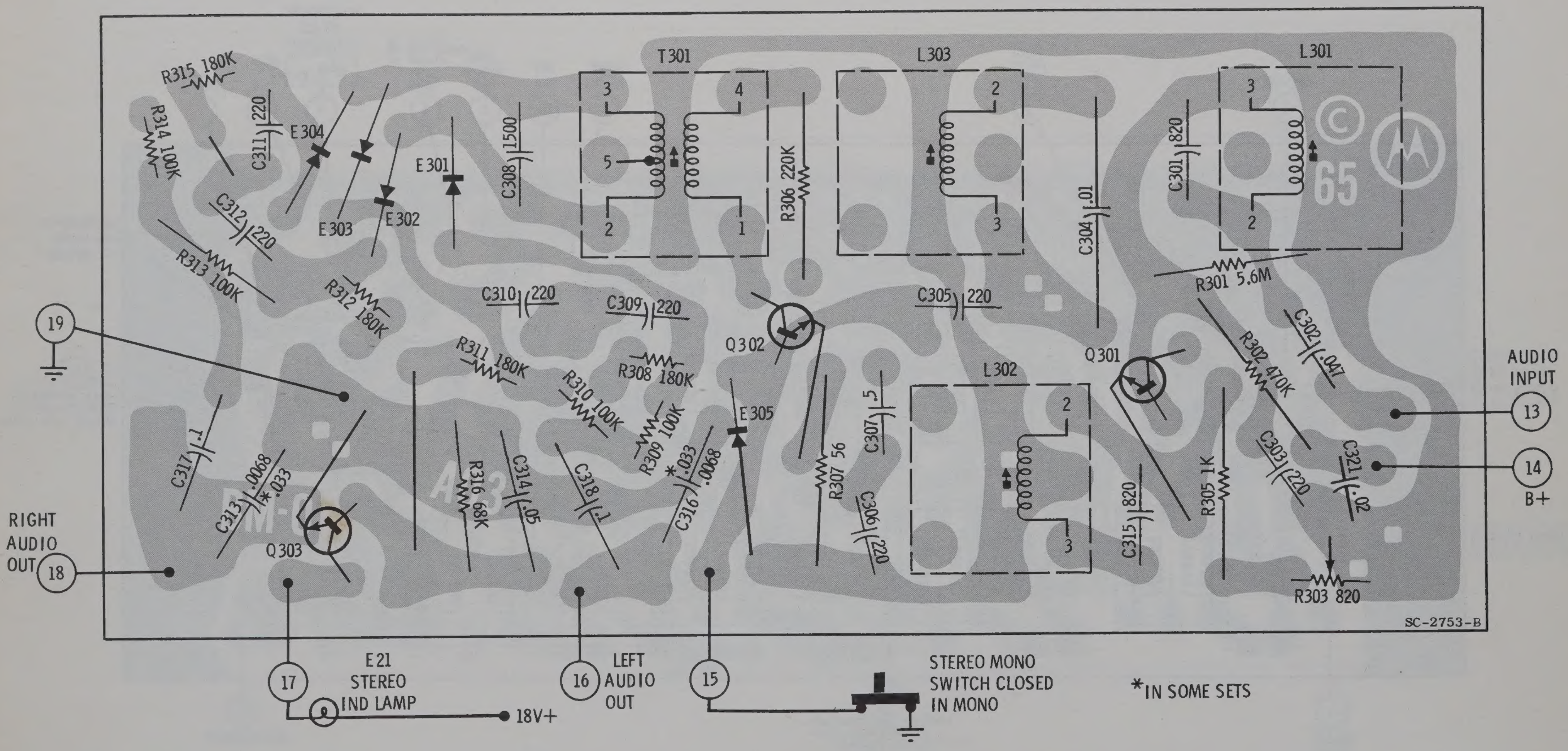
TOP VIEW

AM-FM IF CIRCUIT BOARD - HS-62257


FM IF INPUT 10.7MC
①
PILOT SQUELCH
#28 NOT ON BOARD (ON OTHER END OF LEAD)
㉘
TO METER AMP
⑪
SHIELD OF CO-AX CABLE IF INPUT
CO-AX SHIELD 455KC INPUT GROUNDS HERE
(FM TO M/X INPUT)
#13 NOT ON BOARD LOCATED ON WIRE
⑬
TO AFC DEFEAT SW (SOLDERED IN)
⑦ B+ 10V
⑨ AFC
⑥
FM MUTE SW IN ON POSITION
⑧ FM MUTE TO BOTTOM OF M/X BOARD
⑤ AM AUDIO OUT
⑩ B+ 10V
④ TO AGC AMP
③ AM IF INPUT 455KC
② B+ 10V
T201
T202
T203
T204
T205
T206
Q201
Q202
Q203
Q204
Q205
E201
E202
R201 150
R202 220
R203 100
R204 100
R205 220
R206 220
R207 8.2K
R208 1.5K
R209 220
R210 220
R211 100
R212 10K
R213 560
R214 1.5K
R215 8.2K
R216 150
R217 220
R218 470
R219 100
R220 33K
R221 100K
R222 100K
R223 330
R224 4.7K
R225 4.7K IN SOME SETS
R226 220K
R227 27K
R228 100K
R229 680K
R230 15K
C201 .02
C202 .02
C203 .005
C204 .02
C205 .02
C206 .002
C207 .005
C208 .002
C209 .02
C210 .02
C211 .002
C212 .02
C213 .002
C214 .002
C215 .02
C216 .02
C217 .02
C218 .02
C219 .1
C220 .3 1MF IN SOME SETS
C221 .1
C222 220
C223 220
C224 220
C225 8MF
C226 .02
C229 7PF
84C60062B01
©1965
SD-2758-A

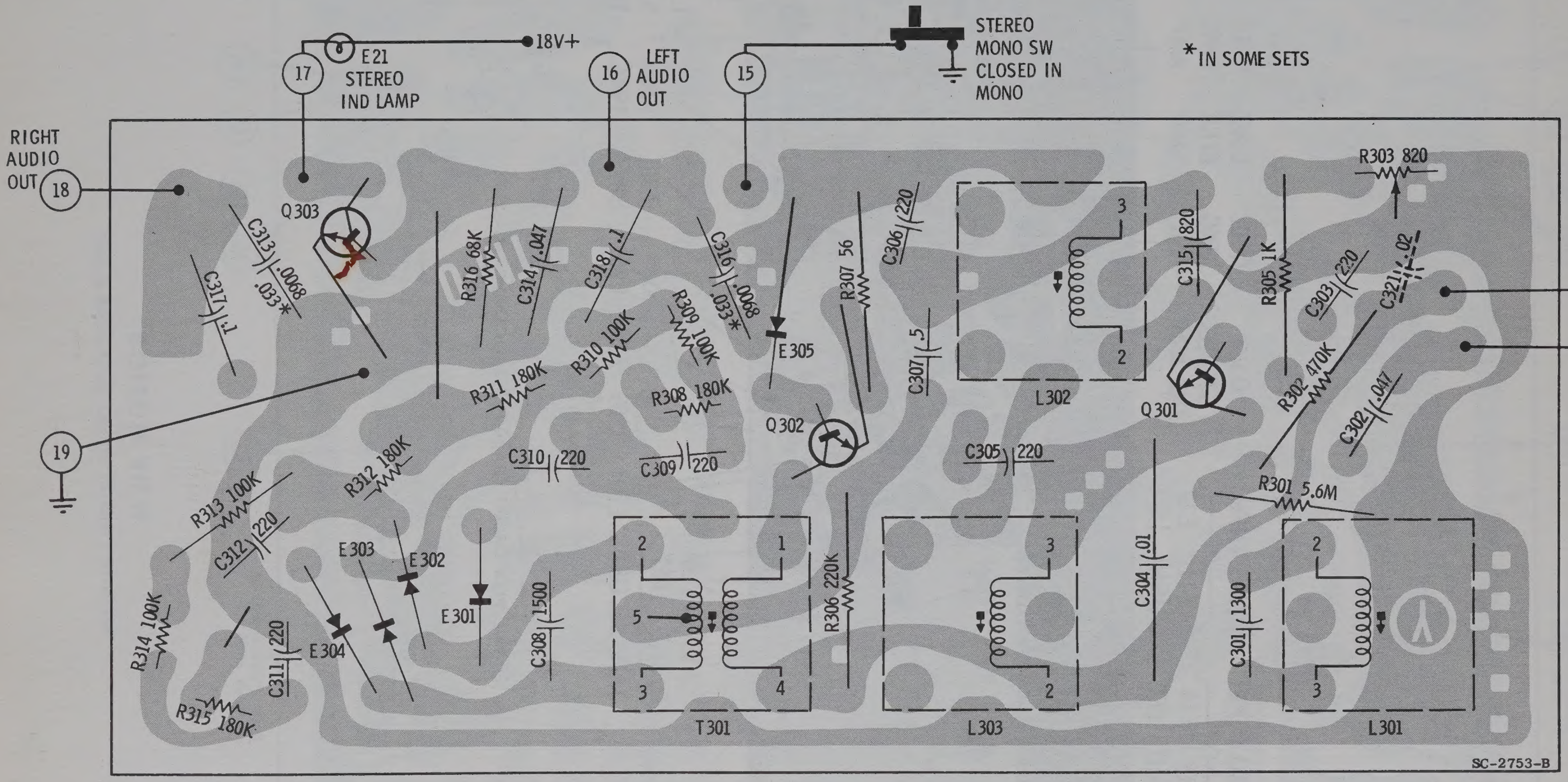
BOTTOM VIEW

AM FM IF CIRCUIT BOARD - HS & PCHS-62257


T301
L303
L301
L302
Q301
Q302
Q303
R301 5.6M
R302 470K
R303 820
R305 1K
R306 220K
R307 56
R308 180K
R309 100K
R310 100K
R311 180K
R312 180K
R313 100K
R314 100K
R315 180K
R316 68K
C301 820
C302 .047
C303 220
C304 .01
C305 220
C306 220
C307 .5
C308 1500
C309 220
C310 220
C311 220
C312 220
C313 .0068 *.033
C314 .05
C315 820
C316 .0068 *.033
C317 .1
C318 .1
C321 .02
E301
E302
E303
E304
E305
AUDIO INPUT
13
14
B+
15
STEREO MONO SWITCH CLOSED IN MONO
16
LEFT AUDIO OUT
17
E21 STEREO IND LAMP
18V+
18
RIGHT AUDIO OUT
19
SC-2753-B
*IN SOME SETS

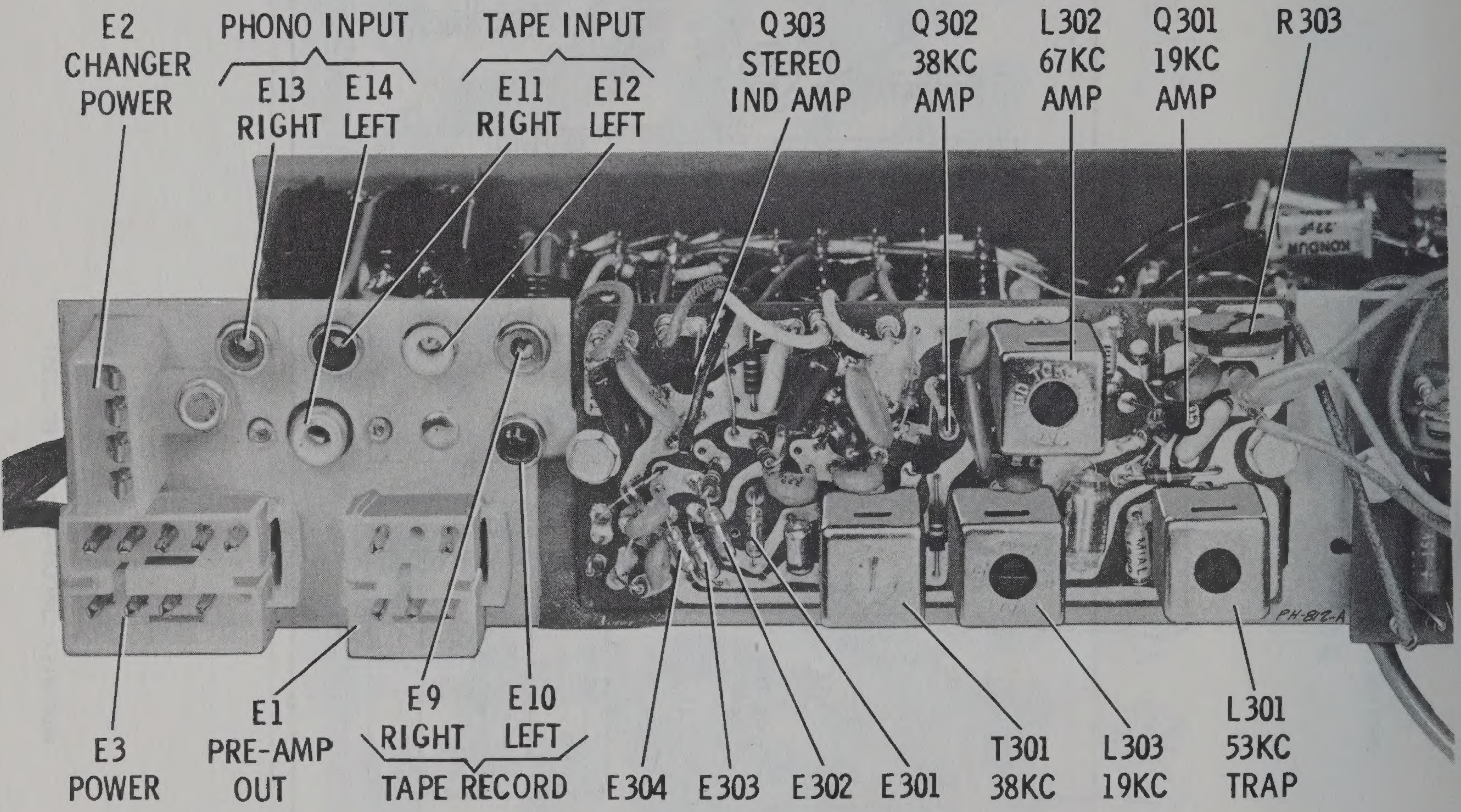
BOTTOM VIEW

MULTIPLEX CIRCUIT BOARD - HS-62257

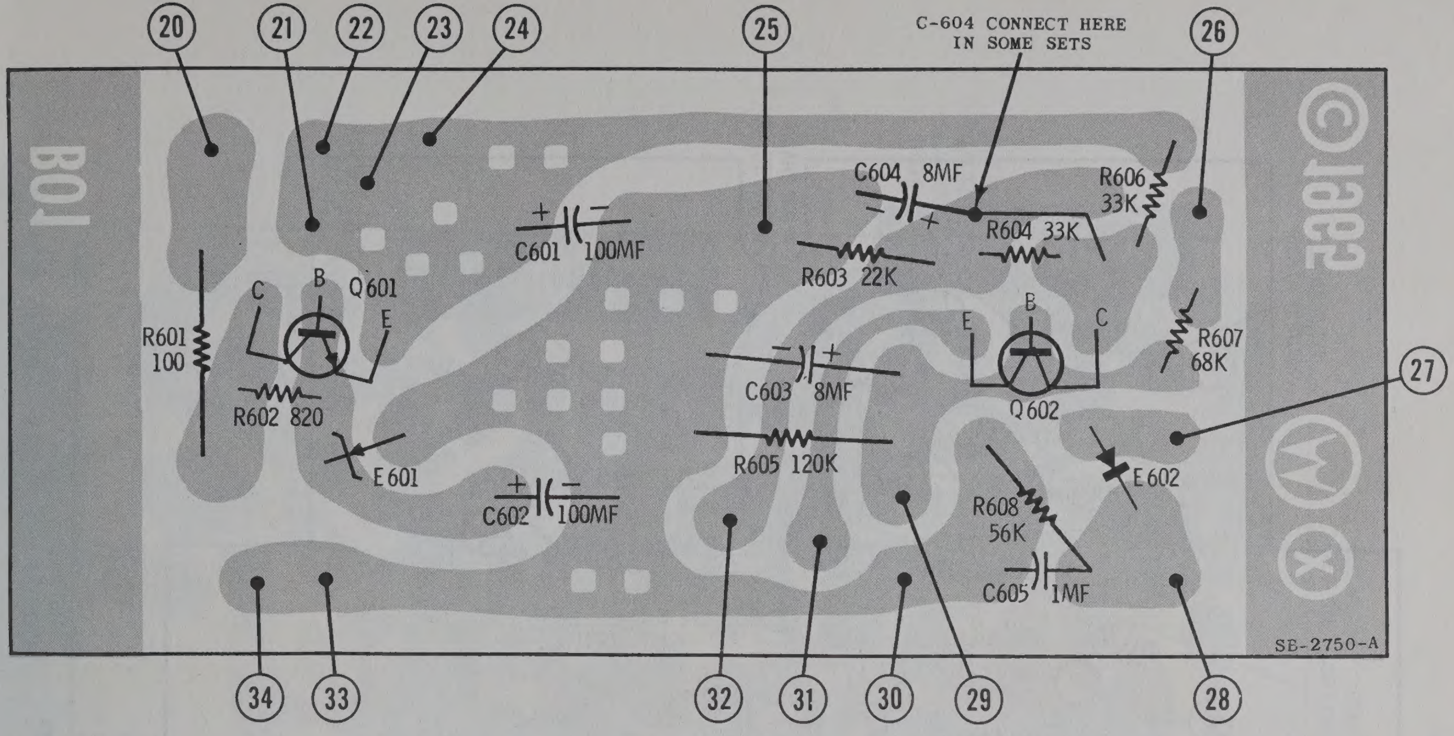

18V+
E21
STEREO
IND LAMP
17
LEFT
AUDIO
OUT
16
15
STEREO
MONO SW
CLOSED IN
MONO
*IN SOME SETS
RIGHT
AUDIO
OUT
18
Q303
C313 .0068 .033*
C317 .1
R316 68K
C314 .047
C318 .1
C316 .0068 .033*
R309 100K
R310 100K
R311 180K
R308 180K
E305
R307 56
C306 220
C307 .5
L302
3
2
C315 820
R305 1K
R303 820
C303 220
C321 .02
B+
14
13
AUDIO
INPUT
Q301
R302 470K
C302 .047
19
Q302
C310 220
C309 220
C305 220
R312 180K
R313 100K
C312 220
E303
E302
E301
E304
C308 1500
R306 220K
C304 .01
C301 1300
R301 5.6M
R314 100K
C311 220
R315 180K
T301
1
2
3
4
5
L303
L301
SC-2753-B

TOP VIEW

MULTIPLEX CIRCUIT BOARD - HS-62257


E2
CHANGER
POWER
PHONO INPUT
E13
RIGHT
E14
LEFT
TAPE INPUT
E11
RIGHT
E12
LEFT
Q303
STEREO
IND AMP
Q302
38KC
AMP
L302
67KC
AMP
Q301
19KC
AMP
R303
E3
POWER
E1
PRE-AMP
OUT
E9
RIGHT
E10
LEFT
TAPE RECORD
E304
E303
E302
E301
T301
38KC
L303
19KC
L301
53KC
TRAP
PH-812-A

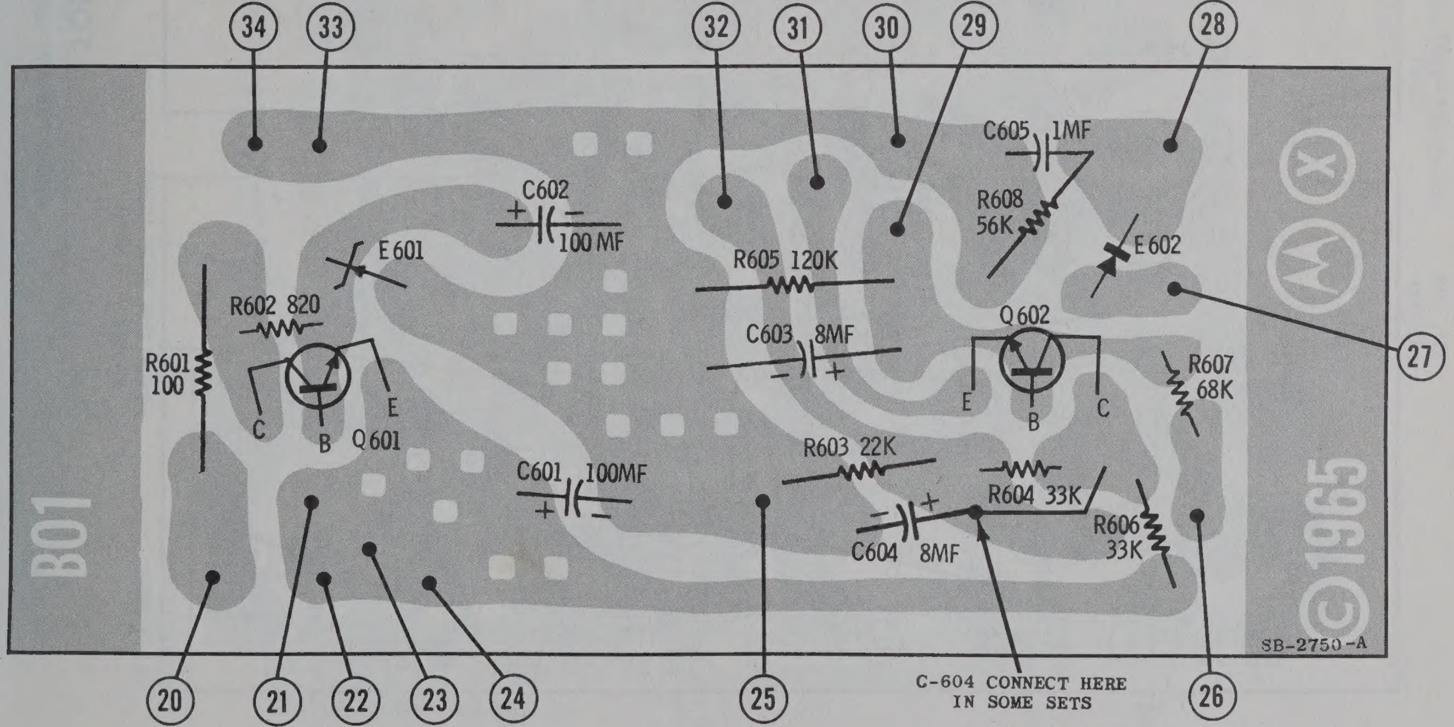
MULTIPLEX CIRCUIT BOARD PARTS LOCATION - HS-62257



20
21
22
23
24
25
C-604 CONNECT HERE IN SOME SETS
26
C604 8MF
R606 33K
R604 33K
C601 100MF
R603 22K
B
Q601
C
E
R601 100
R602 820
E601
C602 100MF
C603 8MF
R605 120K
E
B
C
Q602
R607 68K
27
E602
R608 56K
C605 1MF
SB-2750-A
34
33
32
31
30
29
28

TOP VIEW

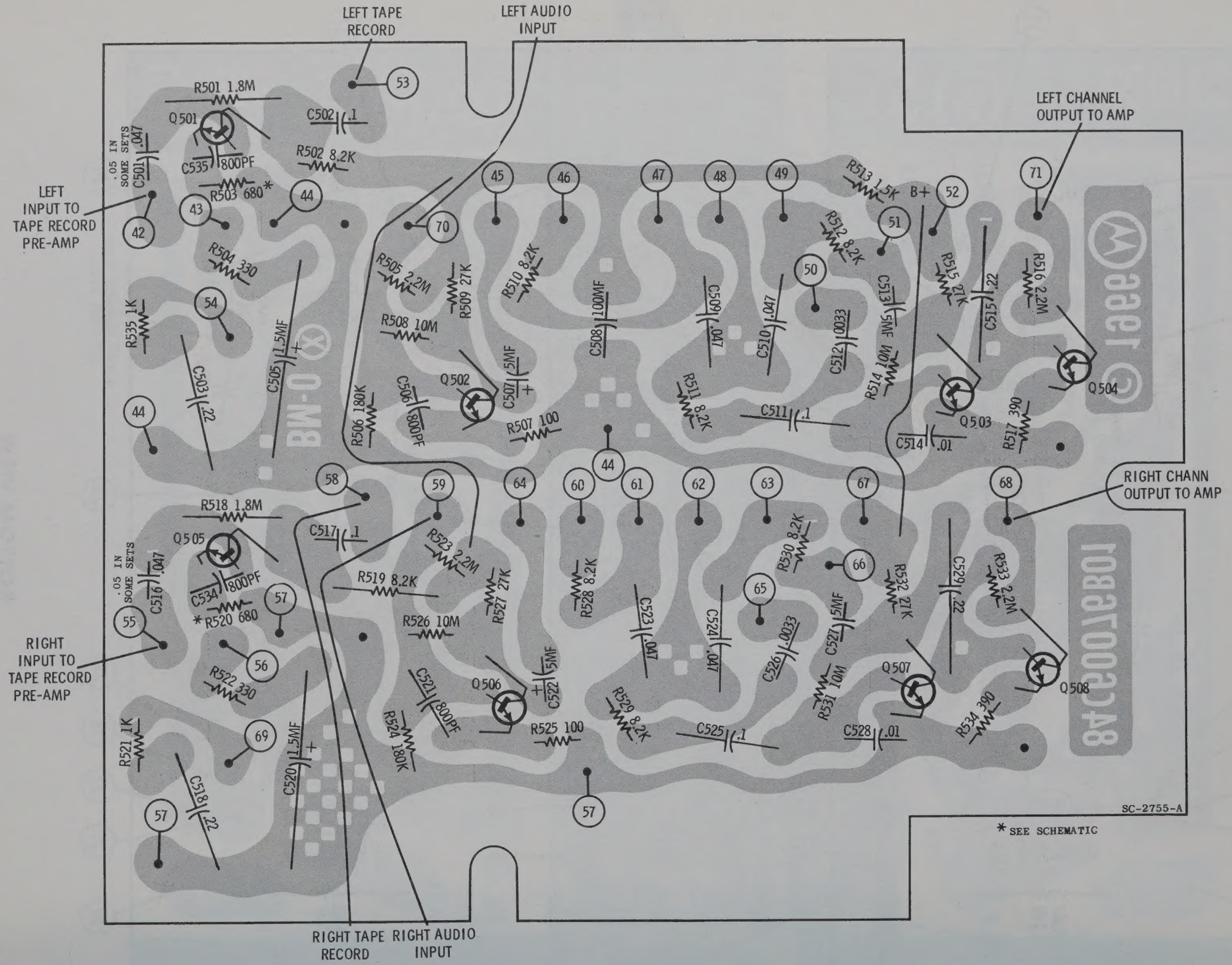
AGC & REGULATOR CIRCUIT BOARD - HS-62257



34
33
32
31
30
29
28
C605 1MF
R608 56K
C602 100 MF
E601
R605 120K
E602
R602 820
Q602
27
R601 100
C603 8MF
R607 68K
E
C
B
Q601
E
C
B
C601 100MF
R603 22K
R604 33K
R606 33K
C604 8MF
B01
©1965
SB-2750-A
20
21
22
23
24
25
C-604 CONNECT HERE IN SOME SETS
26

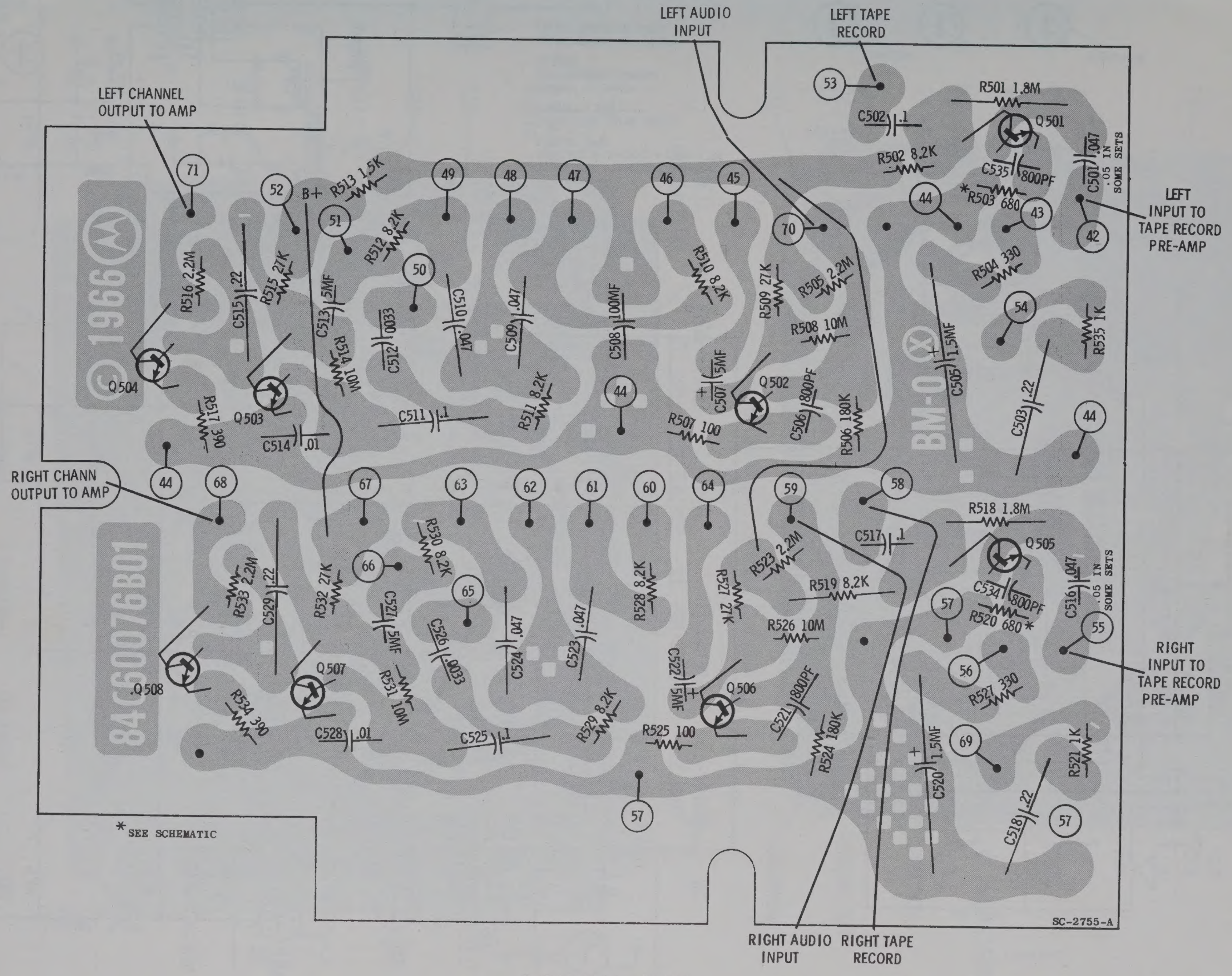
BOTTOM VIEW

AGC & REGULATOR CIRCUIT BOARD - HS-62257


LEFT TAPE RECORD
LEFT AUDIO INPUT
LEFT CHANNEL OUTPUT TO AMP
RIGHT CHANN OUTPUT TO AMP
LEFT INPUT TO TAPE RECORD PRE-AMP
RIGHT INPUT TO TAPE RECORD PRE-AMP
RIGHT TAPE RECORD
RIGHT AUDIO INPUT
53
R501 1.8M
Q501
C502 .1
.05 IN SOME SETS
C501 .047
C535 800PF
R502 8.2K
R503 680*
42
43
44
70
45
46
47
48
49
R513 1.5K
B+
52
71
51
50
R512 8.2K
R504 330
R505 2.2M
R509 27K
R510 8.2K
C508 100MF
C509 .047
C510 .047
C512 .0033
C513 5MF
R515 27K
C515 .22
R516 2.2M
R535 1K
54
R508 10M
C505 1.5MF
C503 .22
Q502
C507 5MF
C506 800PF
R506 180K
R507 100
R511 8.2K
C511 .1
R514 10M
Q503
Q504
C514 .01
R517 390
44
58
59
64
60
61
62
63
67
68
R518 1.8M
Q505
C517 .1
R523 2.2M
R519 8.2K
R528 8.2K
R530 8.2K
66
65
R532 27K
C529 .22
R533 2.2M
.05 IN SOME SETS
C516 .047
C534 800PF
*R520 680
57
55
56
R526 10M
R527 27K
C523 .047
C524 .047
C526 .0033
C527 5MF
R531 10M
Q507
Q508
R522 330
C521 800PF
Q506
C522 5MF
R524 180K
R525 100
R529 8.2K
C525 .1
C528 .01
R534 390
R521 1K
69
C520 1.5MF
57
C518 .22
57
SC-2755-A
* SEE SCHEMATIC

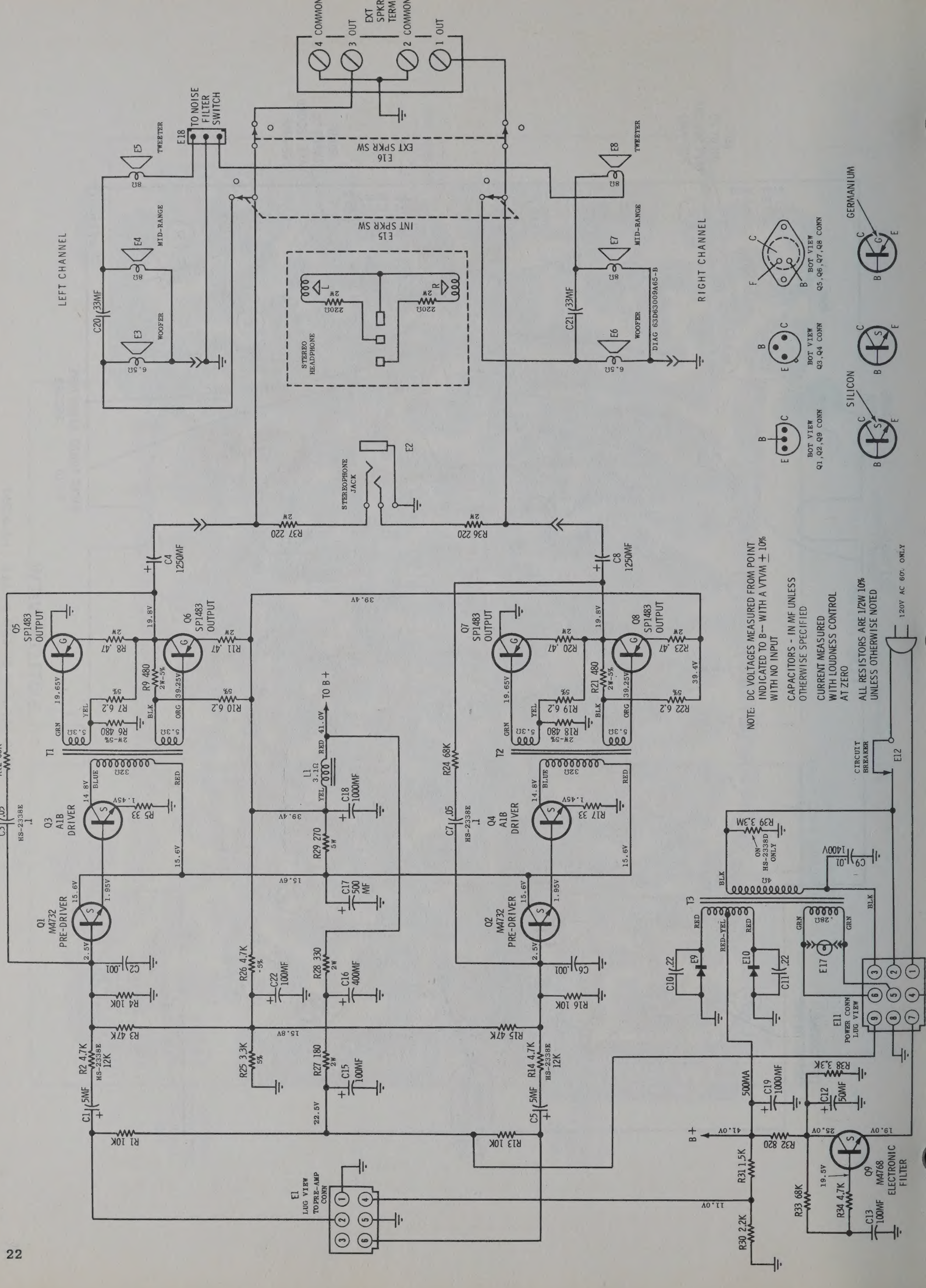
TOP VIEW

AUDIO PRE-AMP CIRCUIT BOARD - HS-62257


LEFT AUDIO INPUT
LEFT TAPE RECORD
LEFT CHANNEL OUTPUT TO AMP
LEFT INPUT TO TAPE RECORD PRE-AMP
RIGHT CHANN OUTPUT TO AMP
RIGHT INPUT TO TAPE RECORD PRE-AMP
RIGHT AUDIO INPUT
RIGHT TAPE RECORD
1966
84C60076B01
BM-0
R501 1.8M
Q501
C502 .1
R502 8.2K
C535 800PF
*R503 680
C501 .047
.05 IN SOME SETS
R504 330
R535 1K
C503 .22
C505 1.5MF
R505 2.2M
R506 180K
C506 800PF
R507 100
R508 10M
R509 27K
R510 8.2K
Q502
C507 5MF
C508 100MF
C509 .047
C510 .047
R511 8.2K
C511 .1
C512 .0033
R512 8.2K
R513 1.5K
B+
C513 5MF
R514 10M
C514 .01
Q503
R515 27K
C515 .22
R516 2.2M
R517 390
Q504
R518 1.8M
Q505
C517 .1
C534 800PF
R520 680*
C516 .047
.05 IN SOME SETS
R519 8.2K
R521 1K
C518 .22
R523 2.2M
R524 180K
C520 1.5MF
C521 800PF
R526 10M
R527 27K
R527 330
Q506
C522 5MF
R525 100
R528 8.2K
R529 8.2K
C523 .047
C524 .047
C525 .1
C526 .0033
R530 8.2K
C527 5MF
R531 10M
Q507
C528 .01
R532 27K
C529 .22
R533 2.2M
Q508
R534 390
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
*SEE SCHEMATIC
SC-2755-A

BOTTOM VIEW

AUDIO PRE-AMP CIRCUIT BOARD - HS-62257

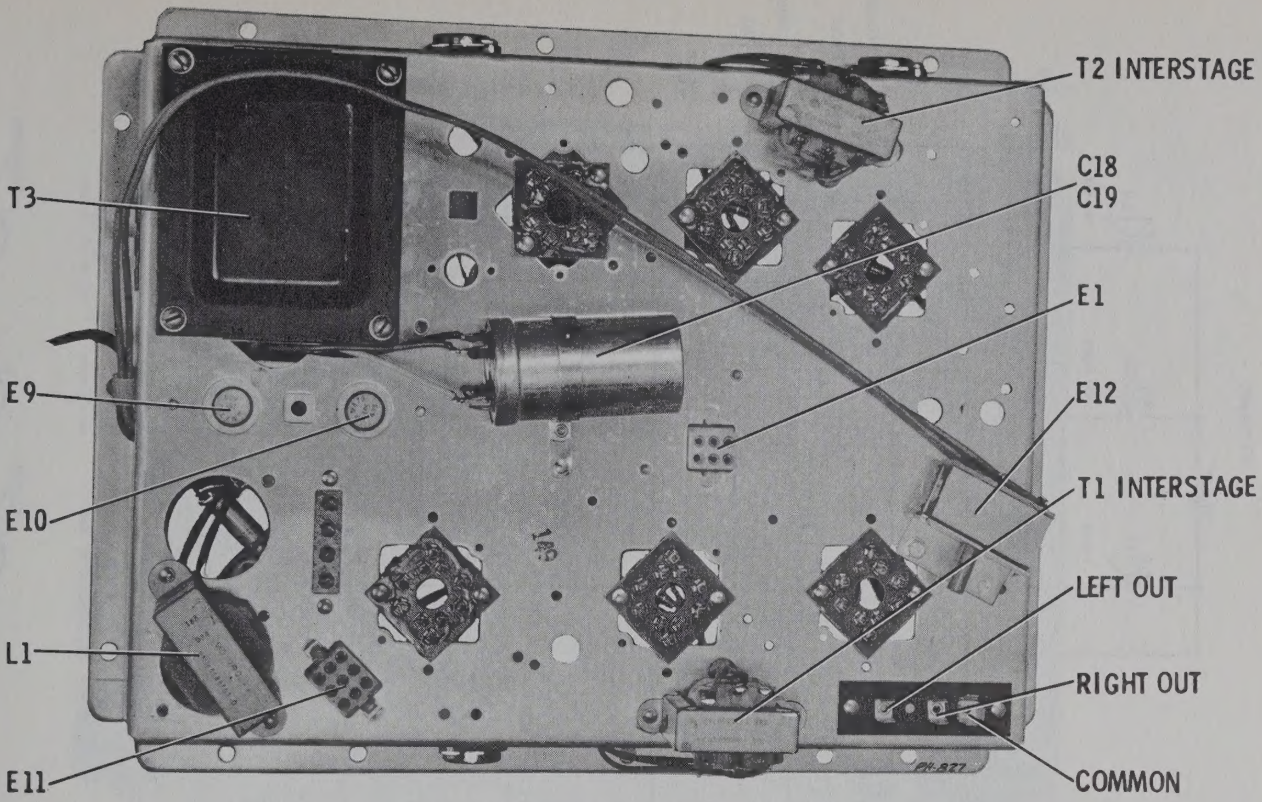

LEFT CHANNEL
RIGHT CHANNEL
E1 LUG VIEW TO PRE-AMP CONN
Q1 M4732 PRE-DRIVER
Q2 M4732 PRE-DRIVER
Q3 A1B DRIVER
Q4 A1B DRIVER
Q5 SP1483 OUTPUT
Q6 SP1483 OUTPUT
Q7 SP1483 OUTPUT
Q8 SP1483 OUTPUT
Q9 M4768 ELECTRONIC FILTER
T1
T2
T3
C1 5MF
C2 .001
C3 .05
C4 1250MF
C5 5MF
C6 .001
C7 .05
C8 1250MF
C9 .01 1400V
C10 .22
C11 .22
C12 50MF
C13 100MF
C15 100MF
C16 400MF
C17 500 MF
C18 1000MF
C19 1000MF
C20 33MF
C21 33MF
C22 100MF
R1 10K
R2 4.7K HS-2338E 12K
R3 47K
R4 10K
R5 33
R6 480 2W-5%
R7 6.2 5%
R8 .47 2W
R9 480 2W-5%
R10 6.2 5%
R11 .47 2W
R12 68K
R13 10K
R14 4.7K HS-2338E 12K
R15 47K
R16 10K
R17 33
R18 480 2W-5%
R19 6.2 5%
R20 .47 2W
R21 480 2W-5%
R22 6.2 5%
R23 .47 2W
R24 68K
R25 3.3K 5%
R26 4.7K 5%
R27 180 2W
R28 330 2W
R29 270 5W
R30 2.2K
R31 1.5K
R32 820
R33 68K
R34 4.7K
R36 220 2W
R37 220 2W
R38 3.3K
R39 3.3M ON HS-2338D ONLY
HS-2338E .1
L1 3.1Ω
500MA
TO B+
B+
41.0V
39.4V
22.5V
15.8V
15.6V
14.8V
1.95V
1.45V
2.5V
19.65V
19.8V
39.25V
25.0V
19.0V
19.5V
11.0V
5.3Ω
32Ω
4Ω
.28Ω
GRN
YEL
BLK
ORG
BLUE
RED
RED-YEL
E2
STEREOPHONE JACK
STEREO HEADPHONE
L
R
220Ω 2W
E3 WOOFER 6.5Ω
E4 MID-RANGE 8Ω
E5 TWEETER 8Ω
E6 WOOFER 6.5Ω
E7 MID-RANGE 8Ω
E8 TWEETER 8Ω
E9
E10
E11 POWER CONN LUG VIEW
E12 CIRCUIT BREAKER
E15 INT SPKR SW
E16 EXT SPKR SW
E17
E18 TO NOISE FILTER SWITCH
4 COMMON
3 OUT
2 COMMON
1 OUT
EXT SPKR TERM
DIAG 63D63009A65-B
BOT VIEW Q1,Q2,Q9 CONN
BOT VIEW Q3,Q4 CONN
BOT VIEW Q5,Q6,Q7,Q8 CONN
E
B
C
F
SILICON
GERMANIUM
S
G
120V AC 60~ ONLY

NOTE: DC VOLTAGES MEASURED FROM POINT INDICATED TO B− WITH A VTVM ± 10% WITH NO INPUT

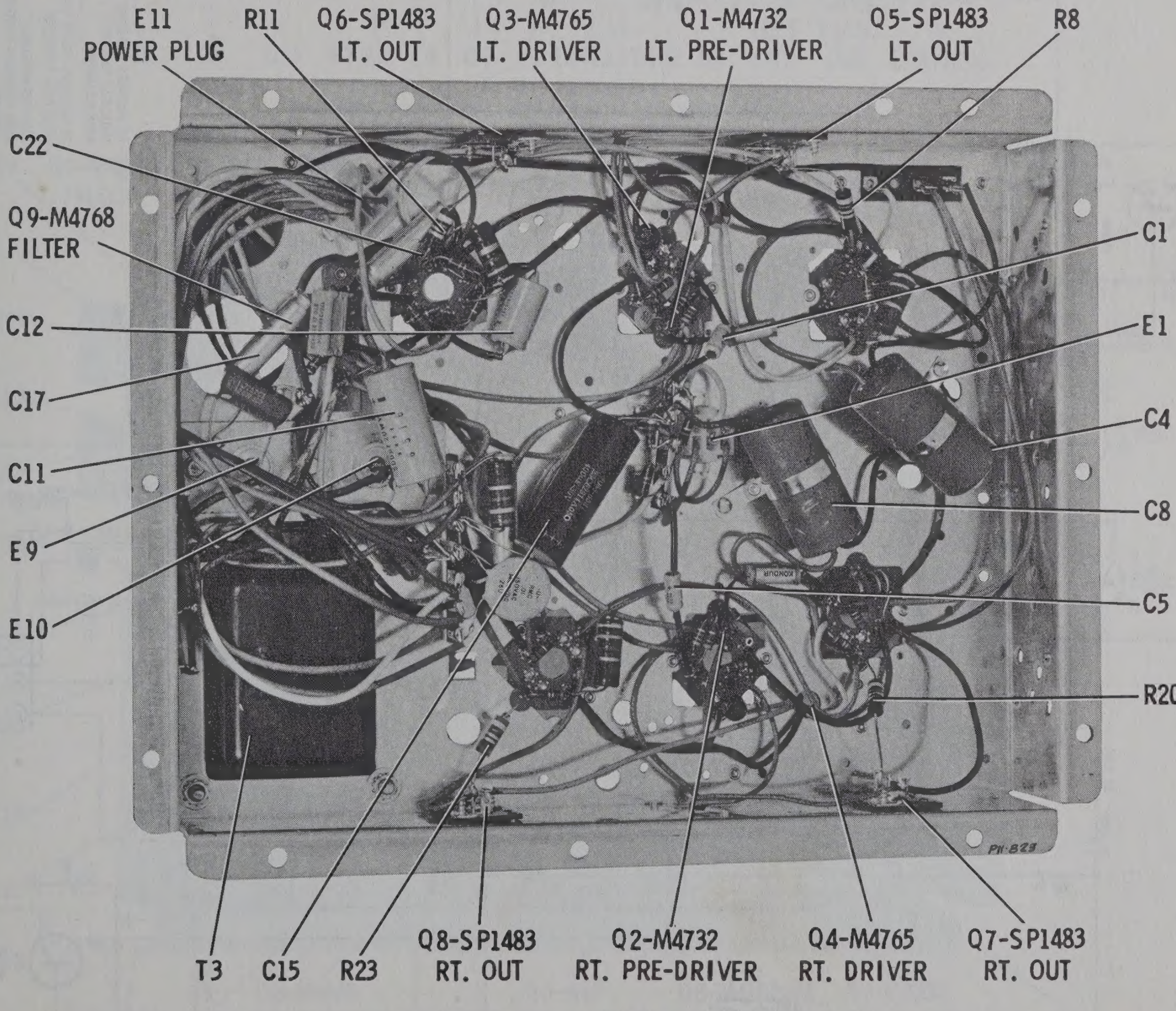
CAPACITORS - IN MF UNLESS OTHERWISE SPECIFIED

CURRENT MEASURED WITH LOUDNESS CONTROL AT ZERO

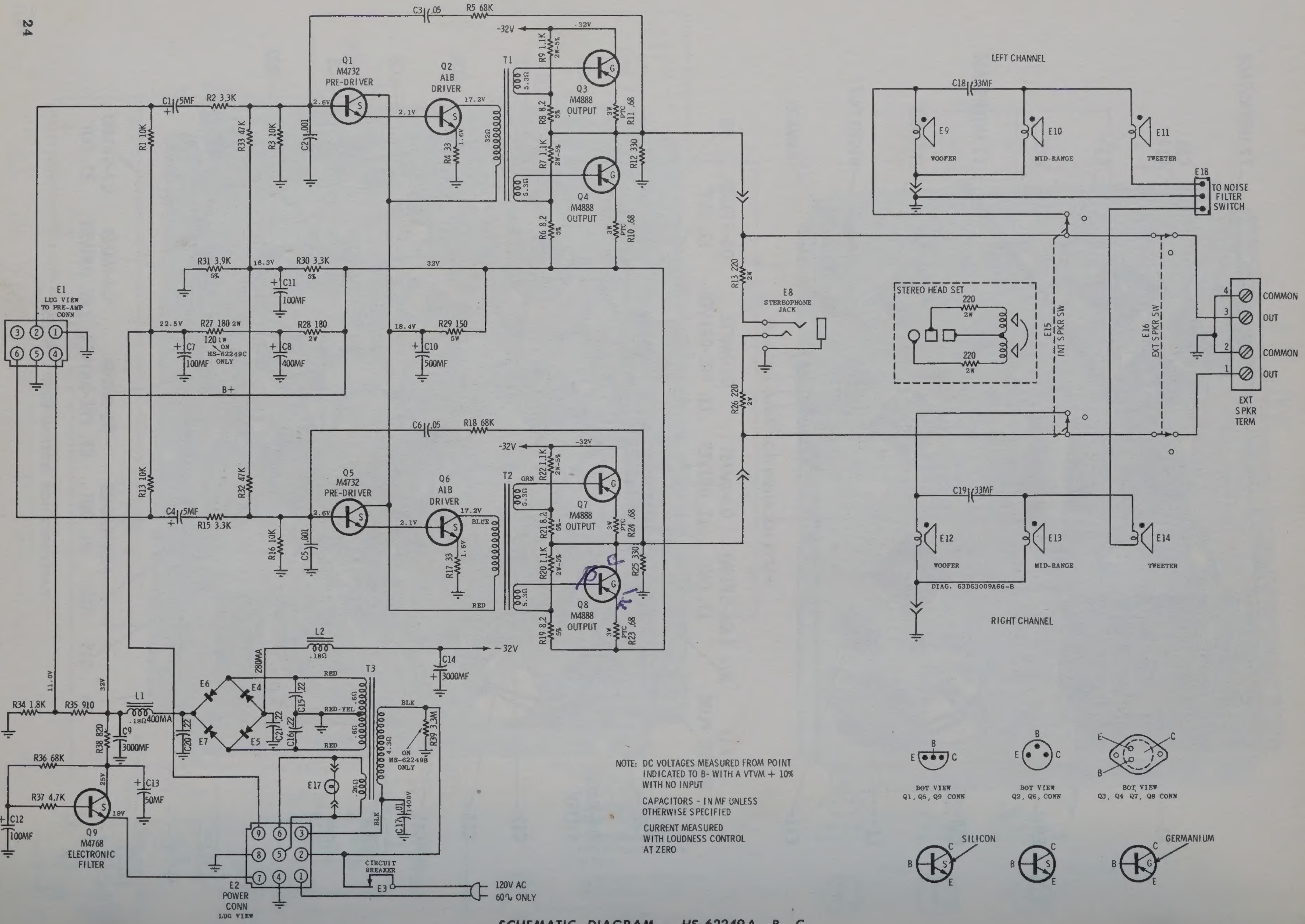
ALL RESISTORS ARE 1/2W 10% UNLESS OTHERWISE NOTED


T2 INTERSTAGE
C18
C19
T3
E1
E9
E12
E10
T1 INTERSTAGE
LEFT OUT
L1
RIGHT OUT
E11
COMMON
PH-827

PARTS LOCATION (TOP VIEW) - HS-2338


E11
POWER PLUG
R11
Q6-SP1483
LT. OUT
Q3-M4765
LT. DRIVER
Q1-M4732
LT. PRE-DRIVER
Q5-SP1483
LT. OUT
R8
C22
Q9-M4768
FILTER
C1
C12
E1
C17
C4
C11
C8
E9
C5
E10
R20
PH-828
T3
C15
R23
Q8-SP1483
RT. OUT
Q2-M4732
RT. PRE-DRIVER
Q4-M4765
RT. DRIVER
Q7-SP1483
RT. OUT

PARTS LOCATION (BOTTOM VIEW) - HS-2338

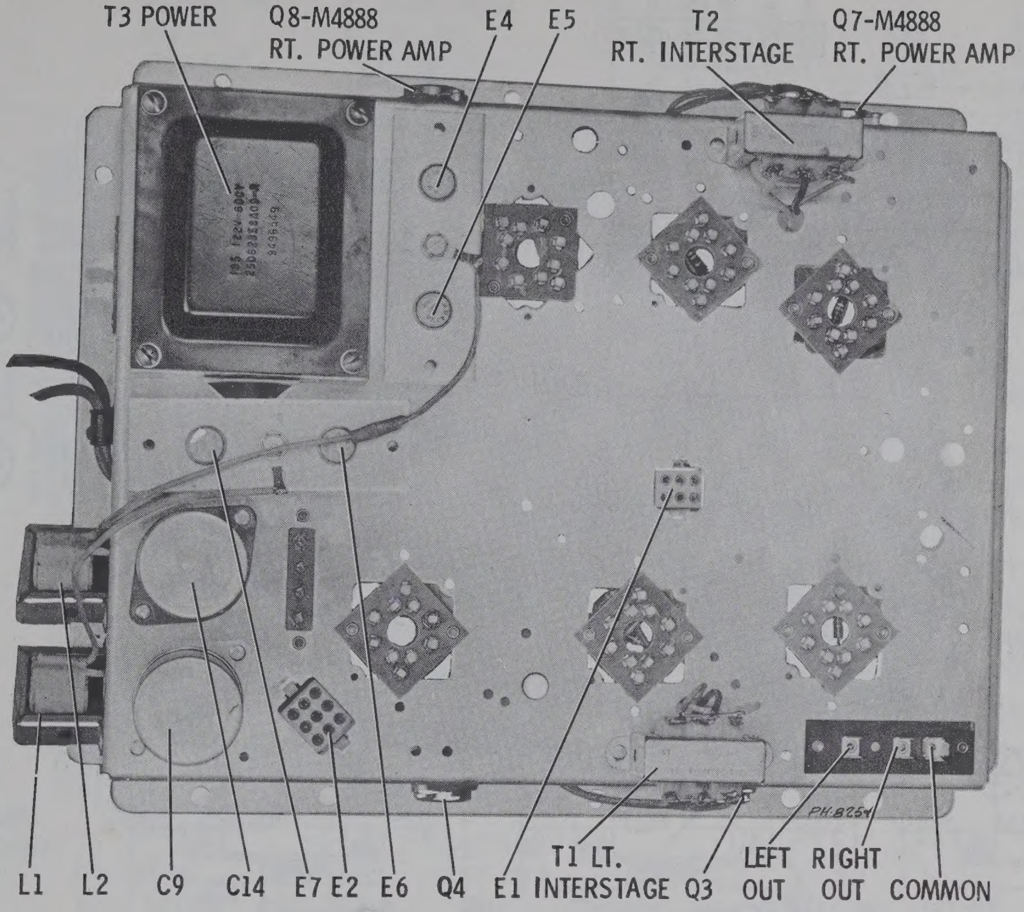

LEFT CHANNEL
RIGHT CHANNEL
C3 .05
R5 68K
-32V
Q1
M4732
PRE-DRIVER
Q2
A1B
DRIVER
T1
Q3
M4888
OUTPUT
Q4
M4888
OUTPUT
R9 1.1K 2W-5%
R8 8.2 5%
R7 1.1K 2W-5%
R6 8.2 5%
R11 .68 3W PTC
R10 .68 3W PTC
R12 330
5.3Ω
32Ω
17.2V
2.1V
2.6V
1.6V
R4 33
C1 5MF
R2 3.3K
R1 10K
R33 47K
R3 10K
C2 .001
R31 3.9K 5%
16.3V
R30 3.3K 5%
32V
C11 100MF
22.5V
R27 180 2W
120 1W ON HS-62249C ONLY
R28 180 2W
C7 100MF
C8 400MF
18.4V
R29 150 5W
C10 500MF
B+
E1
LUG VIEW TO PRE-AMP CONN
C6 .05
R18 68K
Q5
M4732
PRE-DRIVER
Q6
A1B
DRIVER
T2
GRN
BLUE
RED
Q7
M4888
OUTPUT
Q8
M4888
OUTPUT
R22 1.1K 2W-5%
R21 8.2 5%
R20 1.1K 2W-5%
R19 8.2 5%
R24 .68 3W PTC
R23 .68 3W PTC
R25 330
R17 33
R13 10K
R32 47K
C4 5MF
R15 3.3K
R16 10K
C5 .001
R13 220 2W
R26 220 2W
E8
STEREOPHONE JACK
C18 33MF
E9
WOOFER
E10
MID-RANGE
E11
TWEETER
E18
TO NOISE FILTER SWITCH
STEREO HEAD SET
220 2W
E15
INT SPKR SW
E16
EXT SPKR SW
COMMON
OUT
EXT SPKR TERM
C19 33MF
E12
E13
E14
DIAG. 63D63009A66-B
L2
.18Ω
280MA
C14
3000MF
T3
RED
RED-YEL
.6Ω
BLK
4.3Ω
R39 3.3M
ON HS-62249B ONLY
11.0V
R34 1.8K
R35 910
L1
.18Ω 400MA
C20 .22
E6
E4
E7
E5
C15 .22
C21 .22
C16 .22
R38 820
C9 3000MF
R36 68K
C13 50MF
25V
19V
R37 4.7K
C12 100MF
Q9
M4768
ELECTRONIC FILTER
E17
.26Ω
C17 .01 1400V
E2
POWER CONN
LUG VIEW
CIRCUIT BREAKER
E3
120V AC
60∿ ONLY
BOT VIEW
Q1, Q5, Q9 CONN
Q2, Q6, CONN
Q3, Q4 Q7, Q8 CONN
SILICON
GERMANIUM
E
B
C
S
G

NOTE: DC VOLTAGES MEASURED FROM POINT INDICATED TO B- WITH A VTVM + 10% WITH NO INPUT

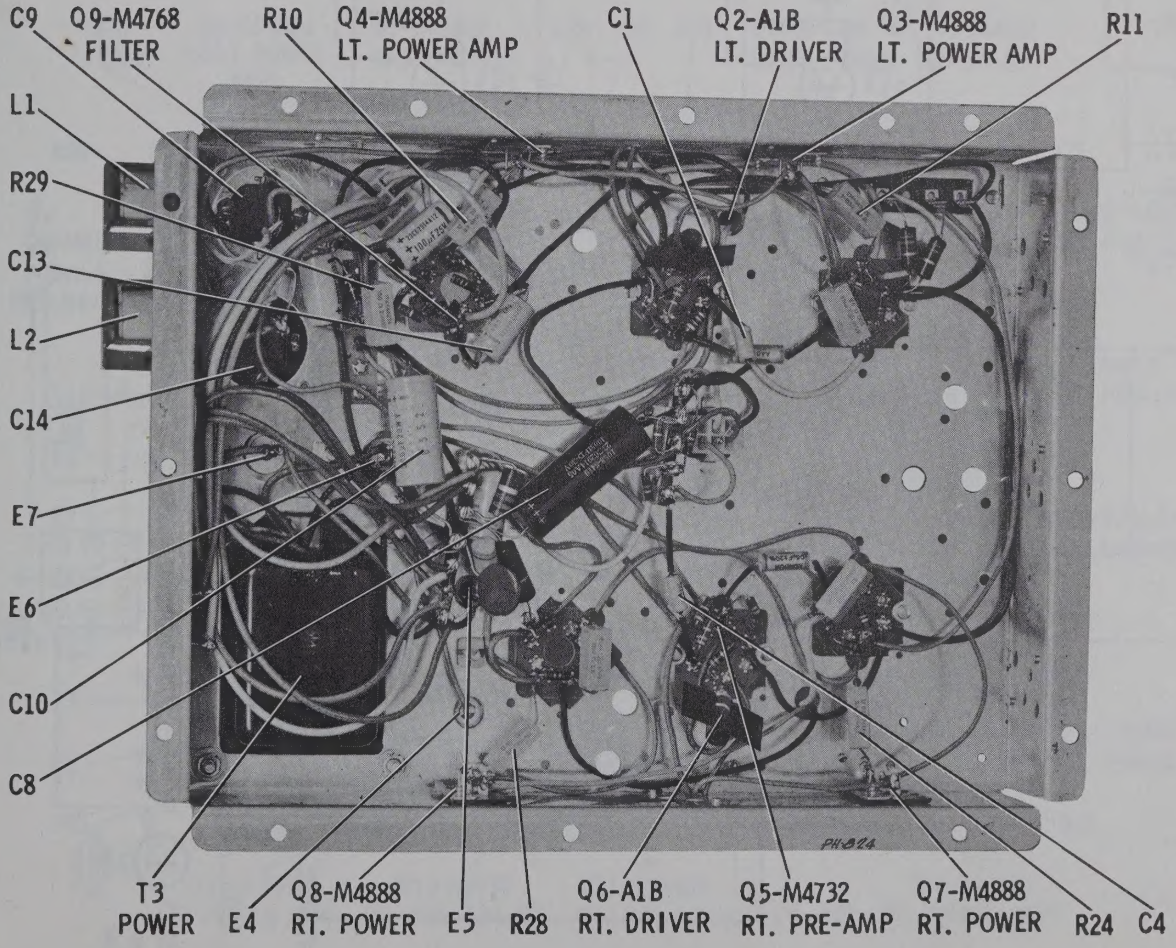
CAPACITORS - IN MF UNLESS OTHERWISE SPECIFIED

CURRENT MEASURED WITH LOUDNESS CONTROL AT ZERO

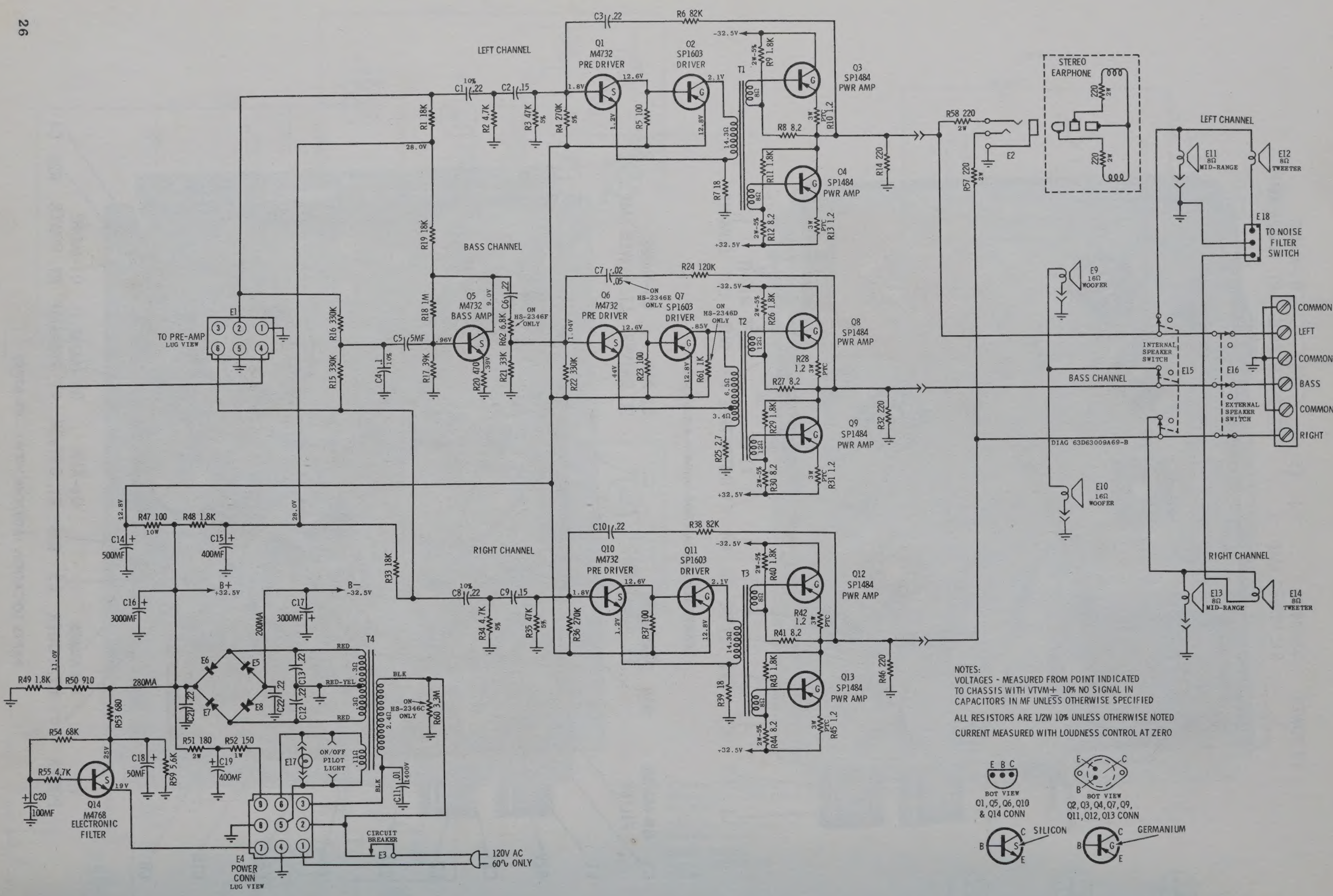
SCHEMATIC DIAGRAM - HS-62249A, B, C


T3 POWER
Q8-M4888
RT. POWER AMP
E4
E5
T2
RT. INTERSTAGE
Q7-M4888
RT. POWER AMP
L1
L2
C9
C14
E7
E2
E6
Q4
E1
T1 LT.
INTERSTAGE
Q3
LEFT
OUT
RIGHT
OUT
COMMON
PH-8254

PARTS LOCATION (TOP VIEW) - HS-62249


C9
Q9-M4768
FILTER
R10
Q4-M4888
LT. POWER AMP
C1
Q2-A1B
LT. DRIVER
Q3-M4888
LT. POWER AMP
R11
L1
R29
C13
L2
C14
E7
E6
C10
C8
T3
POWER
E4
Q8-M4888
RT. POWER
E5
R28
Q6-A1B
RT. DRIVER
Q5-M4732
RT. PRE-AMP
Q7-M4888
RT. POWER
R24
C4
PH-824

PARTS LOCATION (BOTTOM VIEW) - HS-62249

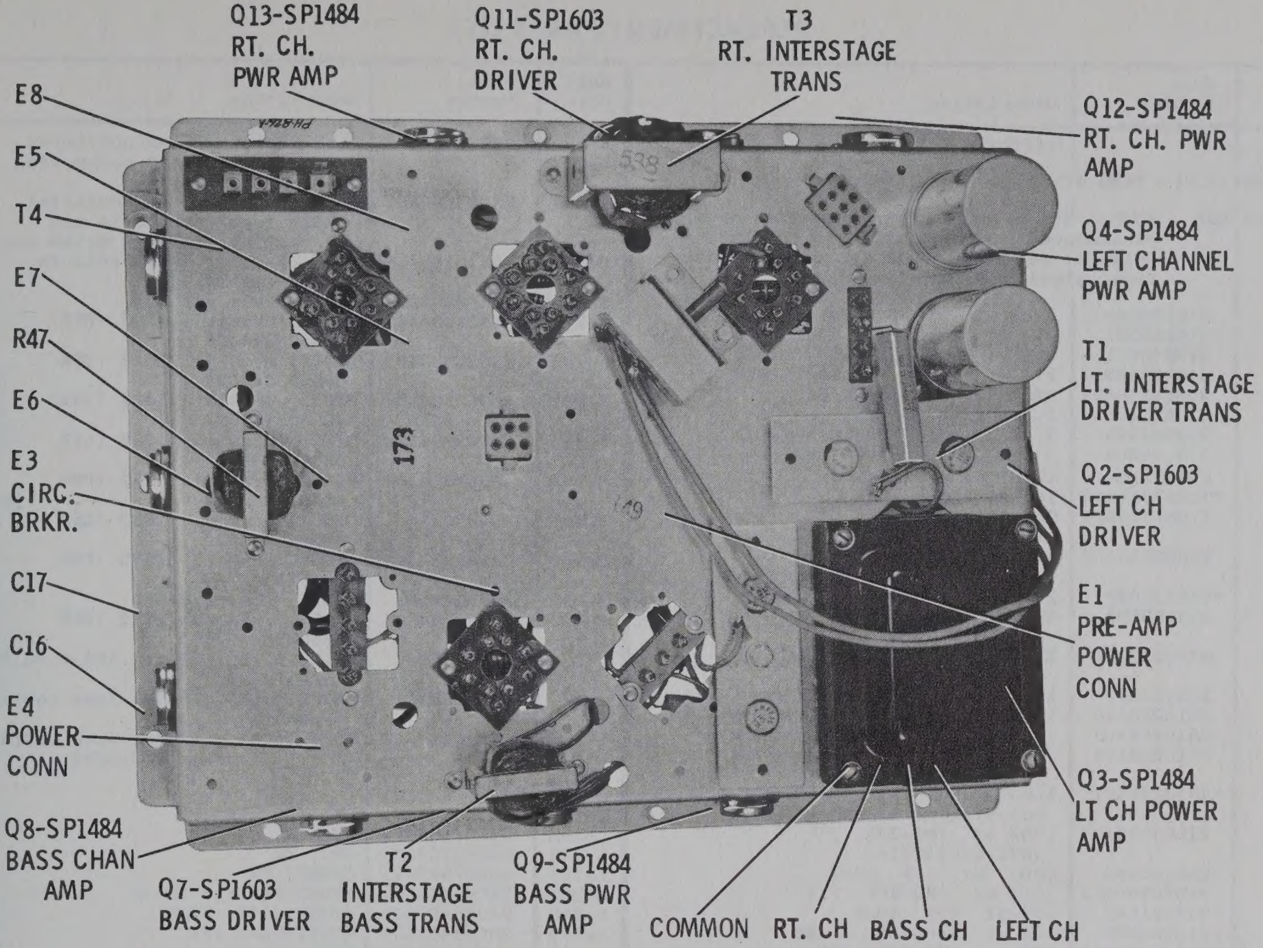

LEFT CHANNEL
BASS CHANNEL
RIGHT CHANNEL
Q1 M4732 PRE DRIVER
Q2 SP1603 DRIVER
Q3 SP1484 PWR AMP
Q4 SP1484 PWR AMP
Q5 M4732 BASS AMP
Q6 M4732 PRE DRIVER
Q7 SP1603 DRIVER
Q8 SP1484 PWR AMP
Q9 SP1484 PWR AMP
Q10 M4732 PRE DRIVER
Q11 SP1603 DRIVER
Q12 SP1484 PWR AMP
Q13 SP1484 PWR AMP
Q14 M4768 ELECTRONIC FILTER
C1 .22 10%
C2 .15
C3 .22
C4 .1 10%
C5 5MF
C6 .22
C7 .02 .05
ON HS-2346E ONLY
ON HS-2346F ONLY
ON HS-2346D ONLY
ON HS-2346C ONLY
C8 .22 10%
C9 .15
C10 .22
C11 .01 1400V
C12 .22
C13 .22
C14 500MF
C15 400MF
C16 3000MF
C17 3000MF
C18 50MF
C19 400MF
C20 100MF
C21 .22
C22 .22
R1 18K
R2 4.7K
R3 47K 5%
R4 270K 5%
R5 100
R6 82K
R7 18
R8 8.2
R9 1.8K 2W-5%
R10 1.2 3W PTC
R11 1.8K
R12 8.2 2W-5%
R13 1.2 3W PTC
R14 220
R15 330K
R16 330K
R17 39K
R18 1M
R19 18K
R20 470
R21 33K
R22 330K
R23 100
R24 120K
R25 2.7
R26 1.8K 2W-5%
R27 8.2
R28 1.2 3W PTC
R29 1.8K
R30 8.2 2W-5%
R31 1.2 3W PTC
R32 220
R33 18K
R34 4.7K 5%
R35 47K 5%
R36 270K
R37 100
R38 82K
R39 18
R40 1.8K 2W-5%
R41 8.2
R42 1.2 3W PTC
R43 1.8K
R44 8.2 2W-5%
R45 1.2 3W PTC
R46 220
R47 100 10W
R48 1.8K
R49 1.8K
R50 910
R51 180 2W
R52 150 1W
R53 680
R54 68K
R55 4.7K
R57 220 2W
R58 220 2W
R59 5.6K
R60 3.3M
R61 1K
R62 6.8K
T1
T2
T3
T4
8Ω
12Ω
14.3Ω
6.5Ω
3.4Ω
.3Ω
.11Ω
2.4Ω
RED
RED-YEL
BLK
E1 TO PRE-AMP LUG VIEW
E2
E3 CIRCUIT BREAKER
E4 POWER CONN LUG VIEW
E5
E6
E7
E8
E9 16Ω WOOFER
E10 16Ω WOOFER
E11 8Ω MID-RANGE
E12 8Ω TWEETER
E13 8Ω MID-RANGE
E14 8Ω TWEETER
E15 INTERNAL SPEAKER SWITCH
E16 EXTERNAL SPEAKER SWITCH
E17 ON/OFF PILOT LIGHT
E18 TO NOISE FILTER SWITCH
STEREO EARPHONE
220 2W
COMMON
LEFT
COMMON
BASS
COMMON
RIGHT
DIAG 63D63009A69-B
1.8V
12.6V
2.1V
1.2V
12.8V
28.0V
9.0V
.96V
.39V
1.04V
.44V
.85V
-32.5V
+32.5V
B+ +32.5V
B− -32.5V
200MA
280MA
11.0V
12.8V
25V
19V
120V AC 60∿ ONLY
E B C
BOT VIEW Q1, Q5, Q6, Q10 & Q14 CONN
BOT VIEW Q2, Q3, Q4, Q7, Q9, Q11, Q12, Q13 CONN
SILICON
GERMANIUM
B C E S G

NOTES:
VOLTAGES - MEASURED FROM POINT INDICATED TO CHASSIS WITH VTVM± 10% NO SIGNAL IN CAPACITORS IN MF UNLESS OTHERWISE SPECIFIED

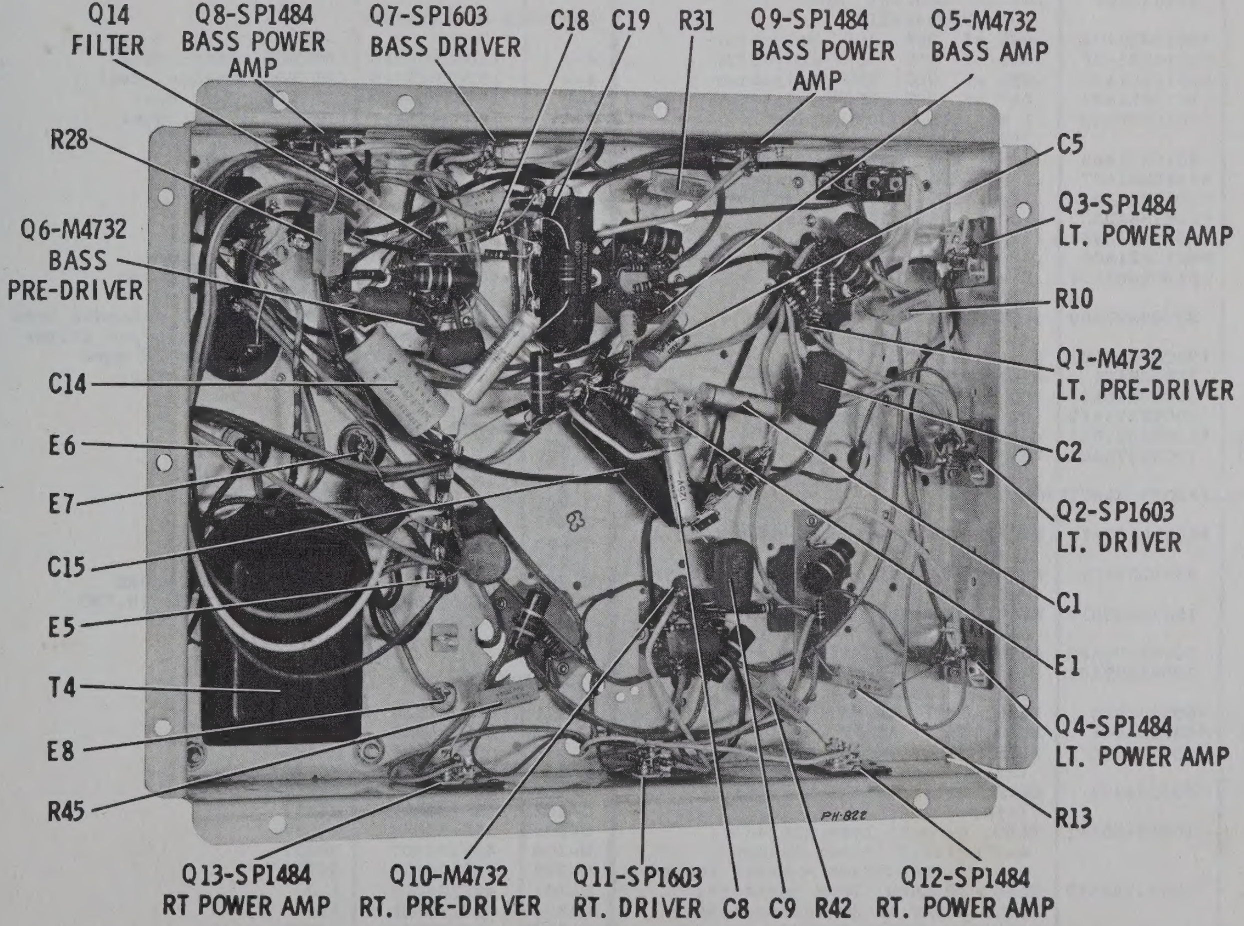
ALL RESISTORS ARE 1/2W 10% UNLESS OTHERWISE NOTED

CURRENT MEASURED WITH LOUDNESS CONTROL AT ZERO

SCHEMATIC DIAGRAM - HS-2346B, C, D, E


Q13-SP1484
RT. CH.
PWR AMP
Q11-SP1603
RT. CH.
DRIVER
T3
RT. INTERSTAGE
TRANS
Q12-SP1484
RT. CH. PWR
AMP
Q4-SP1484
LEFT CHANNEL
PWR AMP
T1
LT. INTERSTAGE
DRIVER TRANS
Q2-SP1603
LEFT CH
DRIVER
E1
PRE-AMP
POWER
CONN
Q3-SP1484
LT CH POWER
AMP
E8
E5
T4
E7
R47
E6
E3
CIRC.
BRKR.
C17
C16
E4
POWER
CONN
Q8-SP1484
BASS CHAN
AMP
Q7-SP1603
BASS DRIVER
T2
INTERSTAGE
BASS TRANS
Q9-SP1484
BASS PWR
AMP
COMMON
RT. CH
BASS CH
LEFT CH

PARTS LOCATION (TOP VIEW) - HS-2346


Q14
FILTER
Q8-SP1484
BASS POWER
AMP
Q7-SP1603
BASS DRIVER
C18
C19
R31
Q9-SP1484
BASS POWER
AMP
Q5-M4732
BASS AMP
R28
Q6-M4732
BASS
PRE-DRIVER
C14
E6
E7
C15
E5
T4
E8
R45
C5
Q3-SP1484
LT. POWER AMP
R10
Q1-M4732
LT. PRE-DRIVER
C2
Q2-SP1603
LT. DRIVER
C1
E1
Q4-SP1484
LT. POWER AMP
R13
Q13-SP1484
RT POWER AMP
Q10-M4732
RT. PRE-DRIVER
Q11-SP1603
RT. DRIVER
C8
C9
R42
Q12-SP1484
RT. POWER AMP

PARTS LOCATION (BOTTOM VIEW) - HS-2346

REPLACEMENT PARTS LIST

Ref. No.	Part Number	Description
		ELECTRICAL PARTS
CHASSIS NCHS & PCHS-62257		
CAPACITORS - NOTE:		The capacitors in this list are recommended replacement types for the original equipment; all are ceramic disc type unless otherwise specified.
	21S180A60	1 pf ± .25 pf 500V NPO
	21S132322	2.4 pf ± .25 pf 500V NPO
	21K645601	3.0 pf ± .5 pf 25V
	21S124489	3.4 pf ± .25 pf 500V NPO
	20B64388A01	TRIMMER: 3.5 to 13 pf
	21K647105	5 pf ± .5 pf 25V
	21K644673	7 pf ± .5 pf 25V
	21S132305	8.2 ± .5 pf 500V NPO
	21S131104	12 pf 5% 500V NPO
	*21C62258A09	100 pf 10% 500V
	21D60500A36	220 pf 10% 25V N750 (USE 21D60500A29)
	21C62258A02	220 pf 10% 500V (USE 21R132503)
	*21S135695	220 pf 5% 500V feed thru
	21S180B08	800 pf 10% 500V (USE 21S134327)
	8S10226A09	820 pf 5% 33V N150 polystyrene
	21S120672	1000 pf +100-0% 500V feed thru
	8S10226A10	1300 pf 5% 33V polystyrene
	8S10226A03	1500 pf 5% 25V polystyrene
	8S10226A05	2000 pf 5% 25V N150 polystyrene
	*8S10226A07	10000 pf 5% 63V N150 polystyrene
	21D60500A07	.002 mf +80-20% 25V (USE 21B646414)
	21S180A64	.0033 mf 10% 500V
	21D60500A13	.005 mf +80-20% 25V
	21S121946	.01 mf 20% 500V
	21S124832	.01 mf +100-0% 1.4KV
	*21D60500A41	.01 mf +80-20% 25V
	*8S10222A01	.01 mf 20% 50V polyester
	21D60500A02	.02 mf +80-20% 25V (USE 21K646731)
	21S646998	.02 mf +80-20% 25V (USE 21K646731)
	*8S10222A04	.022 mf 20% 50V polyester
	*8S10221A09	.022 mf 20% 250V polyester
	*8S10221A10	.033 mf 20% 250V polyester
	8S10221A02	.047 mf 20% 250V polyester
	8G10246A40	.1 mf 20% 200V mylar (USE 8K128692)
	8S10221A03	.1 mf 20% 250V polyester
	*8S10221A07	.1 mf 20% 25V polyester
	*8S10221A03	.1 mf 20% 250V polyester
	*23S188A03	1.5 mf 10% 15V lytic
	8G10246A36	.22 mf 20% 25V polyester
	*8S10221A06	.47 mf 20% 250V polyester
	21D62461A07	.5 mf +80-20% 10V (USE 21D62461A04)
	23C63827A09	1 mf +40-20% 10V lytic (USE 23C43280A01)
	*23C60496A21	5 mf 15V lytic
	23S188A01	8 mf 20% 15V lytic
	23C60496A07	100 mf 15V lytic
	23C62914A12	100 mf 25V lytic
C-403	*19C60011B01	VARIABLE, 3 sect: AM
C-101	19C63370A01	VARIABLE, 4 sect: FM
MISCELLANEOUS ELECTRICAL PARTS		
E-1	*15S10183A12	RECEPTACLE, 6-conn: less contacts (amp output)
E-2	9A60233A01	RECEPTACLE, 4-conn: less contacts (phono pwr)
E-3	15S10183A14	RECEPTACLE, 10-conn: less contacts (pwr)
E-8	72P63005A92	METER & PLATE ASSEM: tuning
E-16	28D62887A01	PLUG, 3-conn: less contacts: FM filter cable
E-18	65S135698	BULB, dial: AM-FM
E-19	*65S135698	BULB, dial: AM-FM
E-20	65S125595	BULB, pilot light: .15A-6 to 8V (chgr comp)
E-21	65S134388	BULB, multiplex: 10V-100EFC (stereo ind)
E-23	15S10183A11	PLUG, 6-conn: less contacts; audio input (tuner to amp connecting cables - mates tuner)
E-24	15S10183A13	PLUG, 10-conn: less contacts; pwr (tuner to amp connecting cables - mates tuner)
E-25	28D62887A03	PLUG, 9-conn: less contacts; pwr (tuner to amp connecting cables - mates amp)
E-26	28D62887A02	PLUG, 6-conn: less contacts; audio input (tuner to amp connecting cables - mates amp)
E-27	15S10183A18	PLUG, 2-conn: less contacts (comp light)
E-101	48A62692A01	DIODE, volt var cap
E-201	48S62334A01	DIODE, crystal: 1S32 (USE 48S62334A02)
E-202	48S62334A01	DIODE, crystal: 1S32 (USE 48S62334A02)
E-301	48S62334A01	DIODE, crystal: 1S32 (USE 48S62334A02)
E-302	48S62334A01	DIODE, crystal: 1S32 (USE 48S62334A02)
E-303	48S62334A01	DIODE, crystal: 1S32 (USE 48S62334A02)
E-304	48S62334A01	DIODE, crystal: 1S32 (USE 48S62334A02)
E-305	48S62334A01	DIODE, crystal: 1S32 (USE 48S62334A02)
E-601	48S134850	DIODE, zener: M4850
E-602	48S62334A01	DIODE, crystal: 1S32 (USE 48S62334A02)
	65S125595	BULB, pilot light: .15A-6 to 8V (on-off ind)
	9D62886A01	RECEPTACLE, 3-conn: less contacts (spkr)
	15S10183A17	RECEPTACLE, 2-conn: less contacts (comp light in cabinet)
COILS & CHOKES		
L-101	24C63762A01	RF, FM
L-102	24C63762A02	RF, FM
L-103	24C63763A01	OSC, FM
L-104	24B62587A01	CHOKE, FM
L-301	24C63463A01	STORE CAST: 67KC-53
L-302	24C63463A01	STORE CAST: 67KC
L-303	24C63463A01	MULTIPLEX: 19KC
L-401	*24C63194A01	ANT, AM: xfmr
L-402	*24C63193A01	AM, RF: xfmr
L-403	24C61366A02	OSC, AM
CONTROLS & RESISTORS		
R-1	18D62999A16	CONTROL, bass: dual
R-2	18D62999A16	CONTROL, treble: dual
R-3	18D62999A18	CONTROL, bal: dual
R-4	18D62999A17	CONTROL, loud: dual
R-228	*18B63499A02	CONTROL, gain
R-303	18D63499A01	CONTROL, gain
SWITCHES		
E-4	40D63355A02	SWITCH, AC: off
E-5	40D63355A03	SWITCH, AC: phono
E-6	*40D63184A01	SWITCH, PB function
E-7	40A63596A01	SWITCH, mercury
E-15	*40C65513A07	SWITCH, slide: extended bass
E-16	40C65513A07	SWITCH, slide: noise filter
E-17	40C65513A07	SWITCH, slide: FM mute
	40B63153A01	SWITCH, local-dist
TRANSFORMERS		
T-101	*24C63761A02	ANT, FM
T-102	24C63456A02	IF; FM: 10.7MC
T-201	*24C63456A03	IF: 10.7MC
T-202	24C63456A03	IF: 10.7MC
T-203	*24C63549A04	IF AM: 455KC
T-204	*24C63456A04	IF: 10.7MC
T-205	*24C63561A04	DETECTOR, AM: 455KC
T-206	*24C63759A02	RATIO DETECTOR: 10.7MC
T-301	24C63463A02	DOUBLER: 38KC
T-401	*24C63549A05	IF; AM: 455KC
TRANSISTORS		
Q-101	48S134825	M4825
Q-102	48S134825	M4825
Q-103	48S134825	M4825
Q-104	48S134826	M4826
Q-201	48S134857	M4857
Q-202	48S134857	M4857
Q-203	48S134857	M4857
Q-204	48S134857	M4857
Q-205	48S134732	M4732
Q-301	48S134906	A1J
Q-302	48S134906	A1J
Q-303	48S134768	M4768

REPLACEMENT PARTS LIST

Ref. No.	Part Number	Description
		ELECTRICAL PARTS
CHASSIS NCHS & PCHS-62257		
CAPACITORS - NOTE:		The capacitors in this list are recommended replacement types for the original equipment; all are ceramic disc type unless otherwise specified.
	21S180A60	1 pf ± .25 pf 500V NPO
	21S132322	2.4 pf ± .25 pf 500V NPO
	21K645601	3.0 pf ± .5 pf 25V
	21S124489	3.4 pf ± .25 pf 500V NPO
	20B64388A01	TRIMMER: 3.5 to 13 pf
	21K647105	5 pf ± .5 pf 25V
	21K644673	7 pf ± .5 pf 25V
	21S132305	8.2 ± .5 pf 500V NPO
	21S131104	12 pf 5% 500V NPO
	*21C62258A09	100 pf 10% 500V
	21D60500A36	220 pf 10% 25V N750 (USE 21D60500A29)
	21C62258A02	220 pf 10% 500V (USE 21R132503)
	*21S135695	220 pf 5% 500V feed thru
	21S180B08	800 pf 10% 500V (USE 21S134327)
	8S10226A09	820 pf 5% 33V N150 polystyrene
	21S120672	1000 pf +100-0% 500V feed thru
	8S10226A10	1300 pf 5% 33V polystyrene
	8S10226A03	1500 pf 5% 25V polystyrene
	8S10226A05	2000 pf 5% 25V N150 polystyrene
	*8S10226A07	10000 pf 5% 63V N150 polystyrene
	21D60500A07	.002 mf +80-20% 25V (USE 21B646414)
	21S180A64	.0033 mf 10% 500V
	21D60500A13	.005 mf +80-20% 25V
	21S121946	.01 mf 20% 500V
	21S124832	.01 mf +100-0% 1.4KV
	*21D60500A41	.01 mf +80-20% 25V
	*8S10222A01	.01 mf 20% 50V polyester
	21D60500A02	.02 mf +80-20% 25V (USE 21K646731)
	21S646998	.02 mf +80-20% 25V (USE 21K646731)
	*8S10222A04	.022 mf 20% 50V polyester
	*8S10221A09	.022 mf 20% 250V polyester
	*8S10221A10	.033 mf 20% 250V polyester
	8S10221A02	.047 mf 20% 250V polyester
	8G10246A40	.1 mf 20% 200V mylar (USE 8K128692)
	8S10221A03	.1 mf 20% 250V polyester
	*8S10221A07	.1 mf 20% 25V polyester
	*8S10221A03	.1 mf 20% 250V polyester
	*23S188A03	1.5 mf 10% 15V lytic
	8G10246A36	.22 mf 20% 25V polyester
	*8S10221A06	.47 mf 20% 250V polyester
	21D62461A07	.5 mf +80-20% 10V (USE 21D62461A04)
	23C63827A09	1 mf +40-20% 10V lytic (USE 23C43280A01)
	*23C60496A21	5 mf 15V lytic
	23S188A01	8 mf 20% 15V lytic
	23C60496A07	100 mf 15V lytic
	23C62914A12	100 mf 25V lytic
C-403	*19C60011B01	VARIABLE, 3 sect: AM
C-101	19C63370A01	VARIABLE, 4 sect: FM
MISCELLANEOUS ELECTRICAL PARTS		
E-1	*15S10183A12	RECEPTACLE, 6-conn: less contacts (amp output)
E-2	9A60233A01	RECEPTACLE, 4-conn: less contacts (phono pwr)
E-3	15S10183A14	RECEPTACLE, 10-conn: less contacts (pwr)
E-8	72P63005A92	METER & PLATE ASSEM: tuning
E-16	28D62887A01	PLUG, 3-conn: less contacts: FM filter cable
E-18	65S135698	BULB, dial: AM-FM
E-19	*65S135698	BULB, dial: AM-FM
E-20	65S125595	BULB, pilot light: .15A-6 to 8V (chgr comp)
E-21	65S134388	BULB, multiplex: 10V-100EFC (stereo ind)
E-23	15S10183A11	PLUG, 6-conn: less contacts; audio input (tuner to amp connecting cables - mates tuner)
E-24	15S10183A13	PLUG, 10-conn: less contacts; pwr (tuner to amp connecting cables - mates tuner)
E-25	28D62887A03	PLUG, 9-conn: less contacts; pwr (tuner to amp connecting cables - mates amp)
E-26	28D62887A02	PLUG, 6-conn: less contacts; audio input (tuner to amp connecting cables - mates amp)
E-27	15S10183A18	PLUG, 2-conn: less contacts (comp light)
E-101	48A62692A01	DIODE, volt var cap
E-201	48S62334A01	DIODE, crystal: 1S32 (USE 48S62334A02)
E-202	48S62334A01	DIODE, crystal: 1S32 (USE 48S62334A02)
E-301	48S62334A01	DIODE, crystal: 1S32 (USE 48S62334A02)
E-302	48S62334A01	DIODE, crystal: 1S32 (USE 48S62334A02)
E-303	48S62334A01	DIODE, crystal: 1S32 (USE 48S62334A02)
E-304	48S62334A01	DIODE, crystal: 1S32 (USE 48S62334A02)
E-305	48S62334A01	DIODE, crystal: 1S32 (USE 48S62334A02)
E-601	48S134850	DIODE, zener: M4850
E-602	48S62334A01	DIODE, crystal: 1S32 (USE 48S62334A02)
	65S125595	BULB, pilot light: .15A-6 to 8V (on-off ind)
	9D62886A01	RECEPTACLE, 3-conn: less contacts (spkr)
	15S10183A17	RECEPTACLE, 2-conn: less contacts (comp light in cabinet)
COILS & CHOKES		
L-101	24C63762A01	RF, FM
L-102	24C63762A02	RF, FM
L-103	24C63763A01	OSC, FM
L-104	24B62587A01	CHOKE, FM
L-301	24C63463A01	STORE CAST: 67KC-53
L-302	24C63463A01	STORE CAST: 67KC
L-303	24C63463A01	MULTIPLEX: 19KC
L-401	*24C63194A01	ANT, AM: xfmr
L-402	*24C63193A01	AM, RF: xfmr
L-403	24C61366A02	OSC, AM
CONTROLS & RESISTORS		
R-1	18D62999A16	CONTROL, bass: dual
R-2	18D62999A16	CONTROL, treble: dual
R-3	18D62999A18	CONTROL, bal: dual
R-4	18D62999A17	CONTROL, loud: dual
R-228	*18B63499A02	CONTROL, gain
R-303	18D63499A01	CONTROL, gain
SWITCHES		
E-4	40D63355A02	SWITCH, AC: off
E-5	40D63355A03	SWITCH, AC: phono
E-6	*40D63184A01	SWITCH, PB function
E-7	40A63596A01	SWITCH, mercury
E-15	*40C65513A07	SWITCH, slide: extended bass
E-16	40C65513A07	SWITCH, slide: noise filter
E-17	40C65513A07	SWITCH, slide: FM mute
	40B63153A01	SWITCH, local-dist
TRANSFORMERS		
T-101	*24C63761A02	ANT, FM
T-102	24C63456A02	IF; FM: 10.7MC
T-201	*24C63456A03	IF: 10.7MC
T-202	24C63456A03	IF: 10.7MC
T-203	*24C63549A04	IF AM: 455KC
T-204	*24C63456A04	IF: 10.7MC
T-205	*24C63561A04	DETECTOR, AM: 455KC
T-206	*24C63759A02	RATIO DETECTOR: 10.7MC
T-301	24C63463A02	DOUBLER: 38KC
T-401	*24C63549A05	IF; AM: 455KC
TRANSISTORS		
Q-101	48S134825	M4825
Q-102	48S134825	M4825
Q-103	48S134825	M4825
Q-104	48S134826	M4826
Q-201	48S134857	M4857
Q-202	48S134857	M4857
Q-203	48S134857	M4857
Q-204	48S134857	M4857
Q-205	48S134732	M4732
Q-301	48S134906	A1J
Q-302	48S134906	A1J
Q-303	48S134768	M4768

Ref. No.	Part Number	Description
Q-401	48S134826	M4826
Q-402	48S134826	M4826
Q-403	48S134826	M4826
Q-501	48S134733	M4733
Q-502	48S134733	M4733
Q-503	48S134732	M4732
Q-504	48S134732	M4732
Q-505	48S134733	M4733
Q-506	48S134733	M4733
Q-507	48S134732	M4732
Q-508	48S134732	M4732
Q-601	48S134765	M4765
Q-602	48S134732	M4732
		MECHANICAL PARTS
	*64C63398A02	BACKGROUND, dial: AM-FM
	*1V63054A52	BOARD, etched chassis: AM-RF; incl contacts
	*1V63054A77	BOARD, etched chassis: IF; incl contacts
	*1V63057A93	BOARD, plated chassis: multiplex
	*1V63054A73	BOARD, etched chassis: pre-amp; incl contacts
	*1V63054A75	BOARD, etched chassis: AGC & regulator; incl contacts
	1V63039A19	BRACKET & PULLEY ASSEM: AM-FM tuning; incl mercury sw ret clip
	*1V63054A42	BRACKET & PULLEY ASSEM: AM-FM tuning; incl mercury sw ret clip
	*42A63605A01	CLIP, retaining: mercury sw
	*42A60206B01	CLIP, retaining: to secure spare dial bulb
	39D62885A01	CONTACT, plug: use w/28D62887A01, 28D62887A02 & 28D62887A03 plugs
	39S10184A01	CONTACT, plug: use w/15S10183A11 & 15S10183A13 plugs
	39S10184A05	CONTACTS, recept: hook-up wires to etched boards
	39S10184A02	CONTACT, recept: use w/15S10183A12 recept
	39C66357A01	CONTACT, recept: use w/9A60233A01 recept
	39S10184A02	CONTACT, recept: use w/15S10183A14 recept
	39D62885A02	CONTACT, recept: use w/9D62886A01 & 15S10183A17 recept
	*1V63054A64	DIAL LIGHT RETAINER ASSEM: AM-FM
	5S135024	EYELET, mtg: var cap mtg brkt
	*1V63054A50	FLYWHEEL & SHAFT ASSEM: AM-FM tuning
	5A644549	GROMMET, rubber: var cap mtg brkt
	2S10054A05	NUT, spring: escut mtg
	2S7051	NUT, stamped: 3/8-32 (control mtg)
	*2A60081B01	NUT, tuning shaft: AM-FM log flywheel
	*13C60212B01	OVERLAY, dial bkgnd (PCHS-62257)
	*52B63394A05	POINTER, dial: AM-FM
	1V63039A27	PULLEY & BUSHING ASSEM: AM-FM tuning
E-9	*9A60184A06	RECEPTACLE, 1-pin: blu (right tape output)
E-10	9A60184A07	RECEPTACLE, 1-pin: brn (left tape output - USE 9A60184A02)
E-11	9A60184A05	RECEPTACLE, 1-pin: yel (left tape input - USE 9A60184A02)
E-12	9A60184A03	RECEPTACLE, 1-pin: blk (right tape input - USE 9A60184A02)
E-13	9A60184A04	RECEPTACLE, 1-pin: red (right phono input - USE 9A60184A02)
E-14	9A642235	RECEPTACLE, 1-pin: wht (left phono input)
	*1V63054A83	SCALE & BUSHING ASSEM: AM log
	*1V63054A84	SCALE & BUSHING ASSEM: FM log
	3S9700	SCREW, set: 6-32 (log scale & bushing assem)
	3S2667	SCREW, set: 6-32 (to secure pulley & bushing assem)
	9D60460A51	SOCKET, pilot light: chgr comp
	41A63638A01	SPRING, tension: AM-FM dial cord
	41A471681	SPRING, tension: pulley & bushing assem: AM-FM tuning
	42A62138A01	STRAP, ground
	*46A60086B01	STUD, spacer: dial bkgnd

Ref. No.	Part Number	Description
		ELECTRICAL PARTS
CHASSIS HS-2338C		
CAPACITORS - NOTE: The capacitors in this list are recommended replacement types for the original equipment; all are ceramic disc type unless otherwise specified.		
	21S410127	.001 mf 20% 500V (USE 21R128045)
	21S124832	.01 mf +100-0% 1.4KV
	8S132864	.22 mf 20% 200V mylar (USE 8G10246A36)
	8S135235	.25 mf 20% 125V polyester (USE 8S129291)
	23C62914A11	50 mf +100-0% 50V lytic
	23C62914A12	100 mf +100-10% 25V lytic
	23C62914A05	400 mf 30V lytic
	23C62914A04	500 mf 20V lytic
	23C63176A02	1000-1000 mf 50V lytic
	23C63540A03	1250 mf 25V lytic
MISCELLANEOUS ELECTRICAL PARTS		
E-1	9D62886A02	RECEPTACLE, 6-conn: less contacts (audio input)
E-9	48S134790	RECTIFIER, silicon
E-10	48S134790	RECTIFIER, silicon
E-11	9D62886A03	RECEPTACLE, 9-conn: less contacts (pwr)
E-12	80K648039	CIRCUIT BREAKER
CHOKE		
L-1	25D63588A01	FILTER
RESISTORS		
R-8	17S488266	.47 10% 2W WW
R-11	17S488266	.47 10% 2W WW
R-20	17S488266	.47 10% 2W WW
R-23	17S488266	.47 10% 2W WW
R-29	17S135282	270 10% 5W WW
R-36	17S135057	220 10% 2W WW
R-37	17S135057	220 10% 2W WW
TRANSFORMERS		
T-1	25D63501A01	DRIVER
T-2	25D63501A01	DRIVER
T-3	25D62858A07	POWER
TRANSISTORS		
Q-1	48S134732	M4732
Q-2	48S134732	M4732
Q-3	48S134899	A1B
Q-4	48S134899	A1B
Q-5	48S134766	SP1483
Q-6	48S134766	SP1483
Q-7	48S134766	SP1483
Q-8	48S134766	SP1483
Q-9	48S134768	M4768
		MECHANICAL PARTS
	39D62885A03	CONTACT, recept; long: use w/9D62886A02 recept
	39D62885A02	CONTACT, recept; short: use w/9D62886A02 & 9D62886A03 recept
	30S189A04	CORD, AC line (USE 30K645311)
	14A543810	INSULATOR, transistor
	3S132845	SCREW, tpg: #6x1/2; clu hd (trans mtg)
	9B542339	SOCKET, transistor
	31C60984A09	TERMINAL, on-off pilot
	*31C60984A08	TERMINAL, spkr conn
		ELECTRICAL PARTS
CHASSIS HS-62249		
CAPACITORS - NOTE: The capacitors in this list are recommended replacement types for the original equipment; all are ceramic disc type unless otherwise specified.		
	21S410127	.001 mf 20% 500V (USE 21R128045)
C-17	21S124832	.01 mf +100-20% 1.4KV

Ref. No.	Part Number	Description
	23C63517A02	CAPACITOR: .33mf 25V lytic (spkrs - USE 23K754512)
	55C63659A23	CASTER, cabinet (SK555CW & SK558CU)
	*42A60233B01	CLIP, retaining: chassis leads; 4-1/2"
	*42A60189B01	CLIP, ring: to secure tuning meter
	42A63344A02	CLIP, spindle: 45 RPM
	42A641557	CLIP, tubular: light rod mtg (on-off ind)
	9C60992A01	CONNECTOR, plastic: AM ant lead
	39S10184A05	CONTACT, recept: spkr horn leads
	*13D60242B01	ESCUTCHEON, chgr comp: Motorola Solid State
	*1V63055A97	ESCUTCHEON, controls: incls function, dial & log scale overlays
	55C63659A02	FERRULE, leg (SK557CW)
	32A63381A01	GASKET, tee strip: cont escut assem; 42"
	55C63659A28	GLIDE, dome: 1/2 dia; single prong (SK557CW)
	55C62743A62	GLIDE, dome: 5/8 dia; single prong (SK540CW & SK556CU)
	35D60005B05	GRILLE CLOTH (SK540CW)
	35D62643A94	GRILLE CLOTH (SK555CW)
	35D62643A95	GRILLE CLOTH (SK556CU)
	35D62643A96	GRILLE CLOTH (SK557CW)
	35D60005B04	GRILLE CLOTH (SK558CU)
	55C63659A30	KEY, door: decorative: cab front (SK557CW)
	*36C63391A02	KNOB, control: bal-bass-loud-treble
	*36C60256B05	KNOB, pendent: balance
	*36C60256B02	KNOB, pendent: bass
	*36C60256B04	KNOB, pendent: loudness
	*36C60256B01	KNOB, pendent: treble
	*36C63390A03	KNOB, tuning: AM-FM
	16E60031B02	LID, cabinet (SK540CW)
	16E63978A02	LID, cabinet (SK555CW)
	16E63675A02	LID, cabinet (SK556CU)
	16E63977A03	LID, cabinet (SK557CW)
	16E60001B03	LID, cabinet (SK558CU)
	29S10134A09	LUG, recept: spkr horn lead
	29A642914	LUG, recept: spkr horn lead
	29B61453A02	LUG, recept: spkr sw, spkr leads & FM filter
	29K730154	LUG, spade: FM antenna
	*13C67810A11	MEDALLION, "M": escut assem
	*13C60236B02	MEDALLION, X100 (SK540CW)
	*13C60236B03	MEDALLION, X200 (SK555C thru SK558C)
	2S119913	NUT, hex: 8-32 (spkr mtg)
	2A63473A01	NUT, knurled: earphone recept mtg
	2S7051	NUT, stamped: earphone recept mtg to brkt
	*13C63444A02	OVERLAY, dial: AM-FM
	*13C63443A03	OVERLAY, function: bal-bass-loud-treble & etc.
	*13B63442A03	OVERLAY, log scale: AM
	*13B63442A04	OVERLAY, log scale: FM
	55C63659A43	PLATE, back: door pull (SK556CU)
	55C63659A36	PLATE, back: door pull (SK558CU)
	55C63659A29	PLATE, back; key (SK557CW)
	28K736072	PLUG, shorting: ant & tape input term
	55C63659A40	PULL, door; decorative: cab front (SK556CU)
	55C63659A37	PULL, door; decorative: cab front (SK558CU)
	38B63393A02	PUSHBUTTON, function sw
	9C60671A07	RECEPTACLE, earphone: chgr comp
	47K645074	ROD, light cond: on-off ind
	*34D63399A02	SCALE, dial: AM-FM
	26A67689A01	SHIELD, light: on-off ind (SK540CW & SK556CU)
	55C63659A24	SOCKET, caster (SK555CW & SK558CU)
	9D60460A41	SOCKET, pilot light: on-off ind
E-11 & E-14	50E63715A02	SPEAKER HORN
E-10 & E-13	*50D63626A04	SPEAKER, 6 PM: 6.5Ω VC
E-9 & E-12	50D63576A02	SPEAKER, 12 PM: 6.5Ω VC
E-9 & E-12	*50D63576A05	SPEAKER, 12 PM: 8Ω VC (SK555CW only)
	55B63618A01	SUPPORT, lid: self balancing
E-15 & E-16	40B63486A02	SWITCH, rocker: int-ext spkr; incl button (chgr comp - USE 40B63486A01)
	*31C62846A11	TERMINAL, ant & tape input
	31C63512A02	TERMINAL, spkr: int-ext
	*4S10058A44	WASHER, non-metallic: tuning shaft & bushing

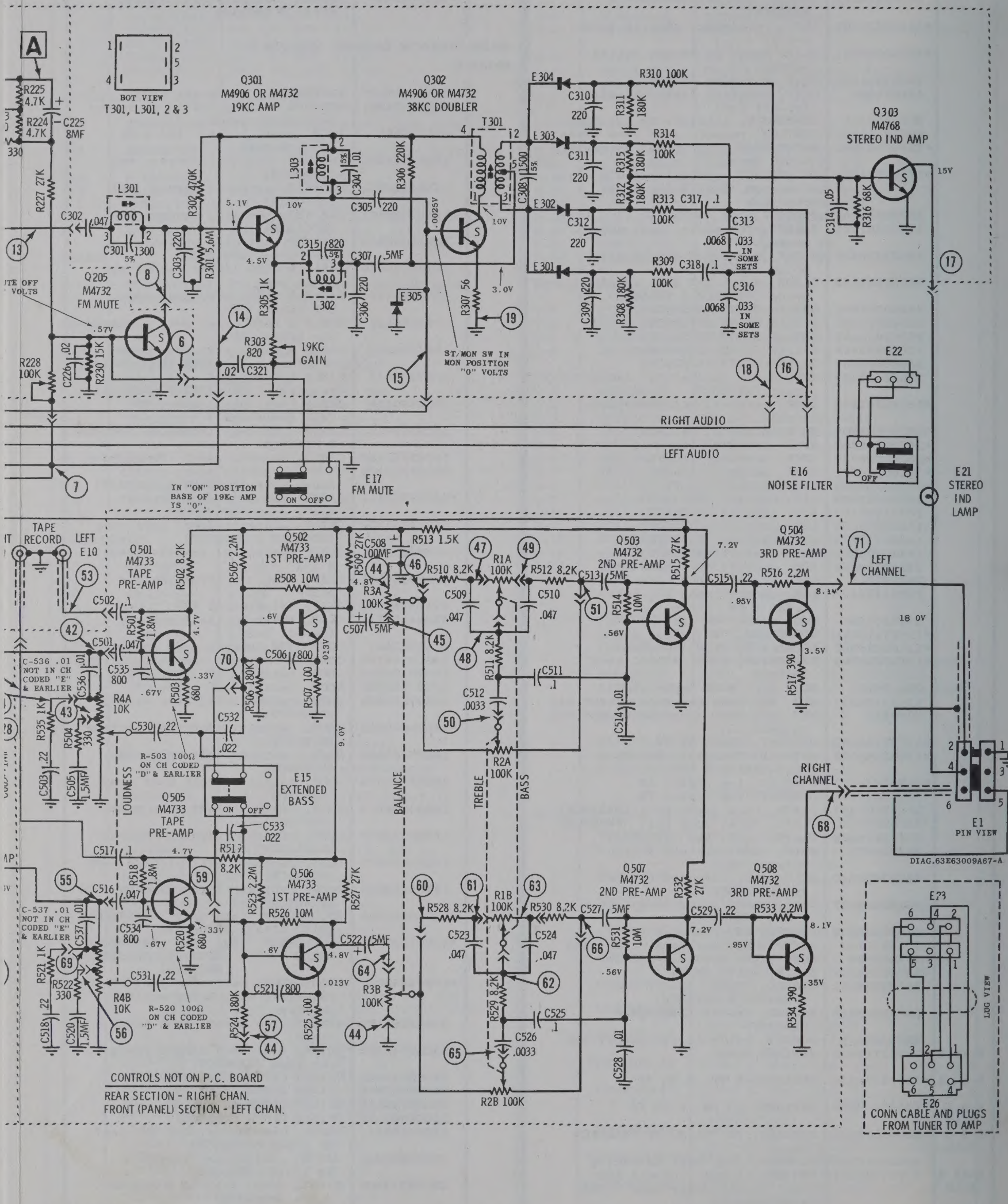
MODEL SK660CW, SD661CW, SD662CM & SD663CU

Ref. No.	Part Number	Description
	64A62358A07	BACKGROUND, slide sw: blk
	43A60084B01	BUSHING, tuning shaft: to secure cont escut assem
	65S125595	BULB, pilot light: .15A-6-8V (on-off ind)
	16E60094B01	CABINET, console; stereo: wal (SK660CW)
	16E60120B01	CABINET, console; stereo: wal (SD661CW)
	16E60095B01	CABINET, console; stereo: mah (SD662CM)
	16E60096B01	CABINET, console; stereo: esperanto (SD663CU)
	30D60099B06	CABLE & PLUG ASSEM: 4-conn mld; phono pwr
	1D60399A44	CABLE & PLUG; mld: gray plug; blk cable; 38"
	1D60399A46	CABLE & PLUG; mld: gray plugs; blu cable; 38"
	1D60399A47	CABLE & PLUG; mld: gray plug; brn cable; 38" (USE 1D60399A44)
	1D60399A45	CABLE & PLUG; mld: gray plug; yel cable; 38" (USE 1D60399A44)
	1D60400A38	CABLE, twin plug: gray; 30" (USE 1D60400A22)
	55C63659A23	CASTER, cabinet (SD661CW, SD662CM & SD663CU)
	55C62743A89	CATCH, magnetic door (SD661CW)
	55C62743A92	CATCH, magnetic door: center doors only (SD661CW & SD662CW)
	*55C62743A83	CATCH, magnetic door: center doors only (SD663CU)
	55C62743A89	CATCH, magnetic door: spkr comp (SD661CW & SD663CU)
	42B60233B01	CLIP, retaining: chassis leads; 4 1/2
	42A60189B01	CLIP, ring: to secure tuning meter
	42A63344A02	CLIP, spindle: 45 RPM
	42A641557	CLIP, tubular: light rod mtg (on-off ind)
	9C60992A01	CONNECTOR, plastic: AM ant lead
	39S10184A05	CONTACT, recept· spkr horn leads
	16E60120B04	DOOR, cabinet: LH (SD661CW)
	16E60120B03	DOOR, cabinet: RH (SD661CW)
	16E63640A03	DOOR, cabinet: left rec storage (SD662CM)
	16E63640A02	DOOR, cabinet: right rec storage (SD662CM)
	16E63640A05	DOOR, cabinet: left spkr comp (SD662CM)
	16E63640A04	DOOR, cabinet: right spkr comp (SD662CM)
	16E60096B04	DOOR, cabinet: left spkr comp (SD663CU)
	16E60096B07	DOOR, cabinet: right spkr comp (SD663CU)
	16E60096B05	DOOR, cabinet: left storage comp (SD663CU)
	16E60096B06	DOOR, cabinet: right storage comp (SD663CU)
	*13D60242B03	ESCUTCHEON, chgr comp: "MOTOROLA SOLID STATE" (SK660CW)
	*13D60242B02	ESCUTCHEON, chgr comp: "MOTOROLA SOLID STATE" (SD661CW, SD662CM & SD663CU)
	*1V3056A39	ESCUTCHEON, controls: incl function, dial & log scales overlays
	32A63381A01	GASKET, tee strip: cont escut assem; 42"
	55C62743A62	GLIDE, dome: 5/8 single prong; cab legs (SK660CW)
	35D62643A63	GRILLE CLOTH (SK660CW)
	35D60005B08	GRILLE CLOTH (SD661CW)
	35D62643A61	GRILLE CLOTH (SD662CM)
	35D62643A59	GRILLE CLOTH (SD663CU)
	55B60235A11	HINGE, continuous: off set leaf; 23 1/4x2 (SD663CU)
	55B60235A10	HINGE, continuous: regular; 23 1/4x2 (SD663CU)
	55C62743A91	HINGE, door: bott LH & top RH doors (SD662CM)
	55C62743A81	HINGE, door: bott RH & top LH doors (SD662CM)
	55C63659A45	HINGE, knife: LH (SD661CW)
	55C63659A44	HINGE, knife: RH (SD661CW)
	*36C63391A01	KNOB, control: bal-bass-loud-treble
	36C60256B05	KNOB, pendant:bal
	*36C60256B03	KNOB, pendant:bass
	36C60256B04	KNOB, pendant:loud
	36C60256B01	KNOB, pendant:treble
	36C63390A03	KNOB, tuning: AM-FM
	16E60094B03	LID, cabinet (SK660CW)
	16E60120B02	LID, cabinet (SD661CW)
	16E60095B02	LID, cabinet (SD662CM)
	16E60096B02	LID, cabinet (SD663CU)
	1V63054A83	LOG SCALE & BUSHING: AM
	1V63054A84	LOG SCALE & BUSHING: FM
	29A642914	LUG, recept: spkr horn leads
	29B61453A02	LUG, recept: spkr sw, spkr & FM filter leads
	29K730154	LUG, spade: FM ant
	*13C67810A10	MEDALLION, "M": escut assem
	*13C60236B01	MEDALLION, X300
	2S119913	NUT, hex: 8-32 (spkr mtg)
	2A63473A01	NUT, knurled: earphone recept
	2S7051	NUT, stamped: earphone recept mtg
	*13C63444A03	OVERLAY, dial: AM-FM
	*13C63443A04	OVERLAY, function: bal-bass-loud-treble & etc.
	*13B63442A05	OVERLAY, log scale: AM
	*13B63442A06	OVERLAY, log scale: FM
	55C62743A80	PLATE, back: door pull (SD662CM)
	28K736072	PLUG, shorting:ant & tape input term
	55C60220A78	PULL, door (SD661CW)
	55C62743A79	PULL, door (SD662CM)
	55C62743A78	PULL, door (SD663CU)
	38B63393A02	PUSHBUTTON, function sw
	9C60671A07	RECEPTACLE, earphone: chgr comp
	47K645074	ROD, light cond: on-off ind
	*34B63399A03	SCALE, dial: AM-FM
E-12 & E-14	50E63715A02	SPEAKER HORN
E-11 thru E-14	50D63542A02	SPEAKER, 8 PM: 8Ω VC
E-9 & E-10	50D63576A03	SPEAKER, 12 PM: 16Ω VC
	55C63659A24	SOCKET, caster (SD661C, SD662C & SD663C)
	9D60460A41	SOCKET, pilot light: on-off ind
	55C62743A90	STRIKE, cab door (SD663CU)
	55C62743A93	STRIKE, cab door: center doors only (SD661CW & SD662CM)
	*55C62743A84	STRIKE, cab door: center doors only (SD663CU)
	55C62743A90	STRIKE, cab door: spkr comp (SD661CW & SD663CU)
	55B63618A01	SUPPORT, lid: self balancing
E-15	40B63685A02	SWITCH, rocker: int-ext spkrs; incl button (chgr comp (USE 40B63486A01)
	31C62846A11	TERMINAL, ant & tape input
	31C63512A02	TERMINAL, spkr: int-ext
	4S10058A44	WASHER, non-metallic: tuning shaft bush

VM122RC & VM123RC PARTIAL RECORD CHANGER LIST

Ref. No.	Part Number	Description
	49P60024A23	ADAPTOR, 50 cycle
	59C63646A01	CARTRIDGE, stereo: VM122
	59C63646A04	CARTRIDGE, stereo: VM123 (16-33-45 RPM)
	59C60133B01	CARTRIDGE, stereo: VM123 (78 RPM)
	49P60081A04	IDLER WHEEL
	36P63024A81	LEVER, on-off-rej-speed
	59P63024A35	MOTOR, phono
	47B62944A01	SPINDLE, 45 RPM
	92-392DS	STYLUS: dual
	92-393D7	STYLUS: LP (VM123)
	92-393S3	STYLUS: 78 (VM123)
	40P63024A30	SWITCH & CONNECTOR
	45P63024A69	TONE ARM ASSEM: complete
	45P63024A55	TRIP LINK

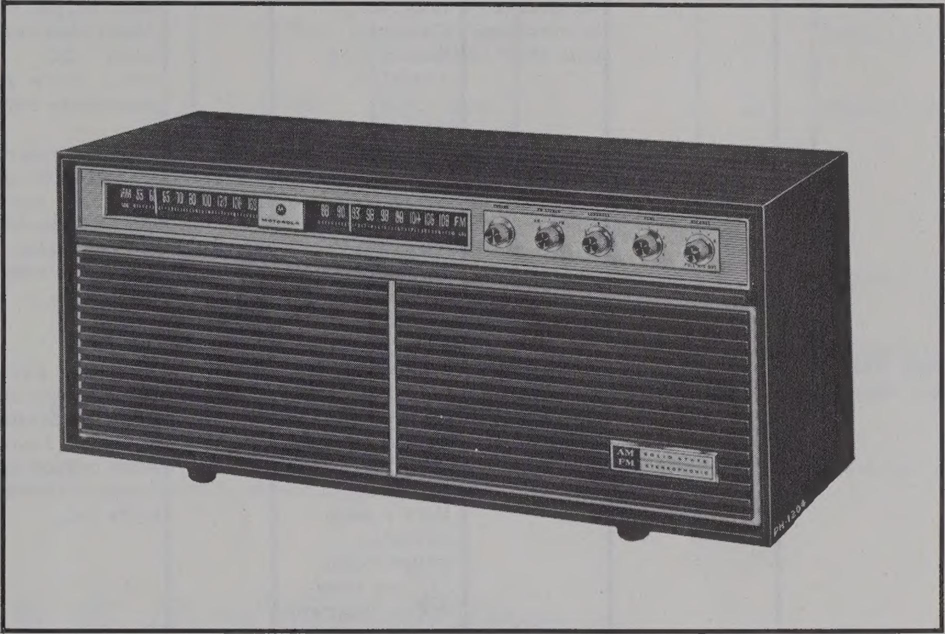
*DENOTES NEW ITEM APPEARING IN ANY LIST FOR FIRST TIME

A
BOT VIEW
T301, L301, 2 & 3
Q301
M4906 OR M4732
19KC AMP
Q302
M4906 OR M4732
38KC DOUBLER
Q303
M4768
STEREO IND AMP
R225 4.7K
R224 4.7K
C225 8MF
330
R227 27K
C302 .047
L301
C301 1300 5%
R302 470K
C303 220
R301 5.6M
5.1V
10V
4.5V
L303
C304 .01 5%
R306 220K
C305 220
T301
C315 820 5%
C307 .5MF
L302
C306 220
E305
R305 1K
R303 820
19KC GAIN
.02 C321
.0025V
C308 1500 5%
10V
R307 56
3.0V
ST/MON SW IN MON POSITION "0" VOLTS
E304
C310 220
R311 180K
R310 100K
E303
C311 220
R315 180K
R314 100K
E302
C312 220
R312 180K
R313 100K
C317 .1
C313 .0068 .033 IN SOME SETS
E301
C309 220
R308 180K
R309 100K
C318 .1
C316 .0068 .033 IN SOME SETS
C314 .05
R316 68K
15V
Q205
M4732
FM MUTE
UTE OFF VOLTS
.57V
C226 .02
R230 15K
R228 100K
RIGHT AUDIO
LEFT AUDIO
IN "ON" POSITION BASE OF 19Kc AMP IS "0".
E17
FM MUTE
ON OFF
E16
NOISE FILTER
E22
OFF
E21
STEREO
IND
LAMP
TAPE RECORD
LEFT
E10
Q501
M4733
TAPE PRE-AMP
R502 8.2K
C502 .1
C501 .047
R501 1.8M
4.7V
C535 800
.67V
.33V
R503 680
C-536 .01 NOT IN CH CODED "E" & EARLIER
C536 .01
R4A 10K
R535 1K
R504 330
C530 .22
C503 .22
C505 1.5MF
R-503 100Ω ON CH CODED "D" & EARLIER
LOUDNESS
R505 2.2M
Q502
M4733
1ST PRE-AMP
R508 10M
.6V
C506 800
R506 180K
R507 100
.013V
C532 .022
E15
EXTENDED BASS
ON OFF
C533 .022
9.0V
R509 27K
C508 100MF
R513 1.5K
4.8V
R3A 100K
C507 5MF
BALANCE
R510 8.2K
R1A 100K
R512 8.2K
C509 .047
C510 .047
R511 8.2K
C511 .1
C512 .0033
R2A 100K
TREBLE
BASS
C513 5MF
Q503
M4732
2ND PRE-AMP
R515 27K
7.2V
R514 10M
.56V
C514 .01
Q504
M4732
3RD PRE-AMP
C515 .22
R516 2.2M
8.1V
.95V
3.5V
R517 390
LEFT CHANNEL
18 0V
RIGHT CHANNEL
E1
PIN VIEW
DIAG.63E63009A67-A
Q505
M4733
TAPE PRE-AMP
C517 .1
4.7V
R517 8.2K
R518 1.8M
C516 .047
C534 800
.67V
.33V
R520 680
C-537 .01 NOT IN CH CODED "E" & EARLIER
C537 .01
R521 1K
R522 330
R4B 10K
C531 .22
C518 .22
C520 1.5MF
R-520 100Ω ON CH CODED "D" & EARLIER
R523 2.2M
Q506
M4733
1ST PRE-AMP
R526 10M
R527 27K
.6V
4.8V
C522 5MF
C521 800
R524 180K
R525 100
.013V
R3B 100K
R528 8.2K
R1B 100K
R530 8.2K
C523 .047
C524 .047
R529 8.2K
C525 .1
C526 .0033
R2B 100K
C527 5MF
Q507
M4732
2ND PRE-AMP
R532 27K
R531 10M
7.2V
.56V
C528 .01
C529 .22
Q508
M4732
3RD PRE-AMP
R533 2.2M
8.1V
.95V
.35V
R534 390
E23
LUG VIEW
E26
CONN CABLE AND PLUGS FROM TUNER TO AMP
CONTROLS NOT ON P.C. BOARD
REAR SECTION - RIGHT CHAN.
FRONT (PANEL) SECTION - LEFT CHAN.
6 7 8 13 14 15 16 17 18 19 28 42 43 44 45 46 47 48 49 50 51 53 55 56 57 59 60 61 62 63 64 65 66 68 69 70 71

stereo fm-am table radio **MANUAL 68P63011A10**

MODEL TT22C
CHASSIS HS-67206

MOTOROLA service manual



GENERAL INFORMATION

TYPE

Model TT22C is a solid state AM/FM monaural and FM stereo (multiplex) receiver. It features a tuned RF stage on AM and FM, AFC on FM, sixteen (16) transistors, twelve (12) diodes and a silicon rectifier.

The receiver has a built-in ferrite rod AM antenna and a line cord type FM antenna. Terminals on the back permit use of an outdoor FM antenna. When no outdoor antenna is used, reception of FM stations may be improved by removing the line cord clip from terminal A and connecting a 36" piece of insulated wire to the terminal.

ELECTRICAL SPECIFICATIONS

Power Requirements: The Model TT22C operates from a 120 volt line AC/DC and consumes approximately 25 watts.

Accessory Speakers: External speakers of eight (8) ohm impedance may be connected by use of the phono type jacks on the rear of the set. The internal speakers are disconnected when external speakers are plugged in.

SERVICE NOTES

CHASSIS REMOVAL

1. Disconnect line cord and leads or clip connected to antenna terminals.

2. Pull off five (5) front control knobs.

3. Remove six (6) small wood screws that fasten cabinet back.

4. Remove six (6) chassis screws from bottom of cabinet (recessed holes).

5. Remove four (4) hex head wood screws from lower edge of dial bracket rail.

CAUTION: Do not remove dial glass screws at center line of rail.

6. Slide chassis and dial bracket out of cabinet as an assembly.

7. Chassis is replaced in reverse order. Be sure speaker lead (phasing) wiring is correct and connect FM antenna leads to inside terminals on cabinet back.

NOTE: If dial glass or lamps have been removed, make sure lamps are carefully re-inserted in their wells. Particular caution should be observed when re-positioning the multiplex indicator lamp.

MOTOROLA INC. 9401 WEST GRAND AVENUE, FRANKLIN PARK, ILLINOIS
PART NO. 68P63011A10 3-67 PRICE 35 CENTS
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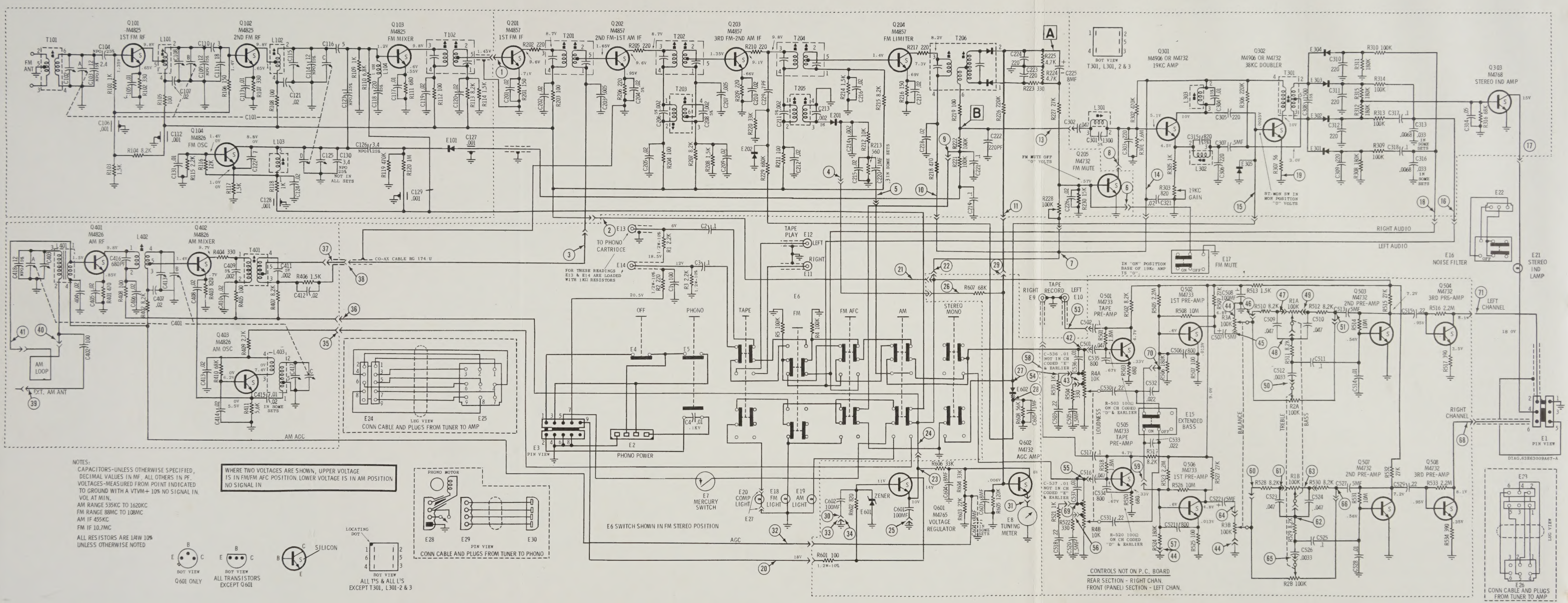

T101
FM ANT
Q101 M4825 1ST FM RF
L101
Q102 M4825 2ND FM RF
L102
Q103 M4857 FM MIXER
T102
Q104 M4826 FM OSC
L103
Q201 M4857 1ST FM IF
T201
Q202 M4857 2ND FM-1ST AM IF
T202
T203
Q203 M4857 3RD FM-2ND AM IF
T204
T205
Q204 M4857 FM LIMITER
T206
A
B
BOT VIEW T301, L301, 2 & 3
Q301 M4906 OR M4732 19KC AMP
Q302 M4906 OR M4732 38KC DOUBLER
T301
Q303 M4768 STEREO IND AMP
L301
L302
L303
Q205 M4732 FM MUTE
FM MUTE OFF "O" VOLTS
19KC GAIN
ST./MON SW IN MON POSITION "O" VOLTS
RIGHT AUDIO
LEFT AUDIO
E22
E16 NOISE FILTER
E21 STEREO IND LAMP
E17 FM MUTE
IN "ON" POSITION BASE OF 19KC AMP IS "O"
Q401 M4826 AM RF
L401
L402
Q402 M4826 AM MIXER
T401
CO-AX CABLE RG 174 U
AM LOOP
EXT. AM ANT
Q403 M4826 AM OSC
L403
AM AGC
E13
TO PHONO CARTRIDGE
E14
FOR THESE READINGS E13 & E14 ARE LOADED WITH 1MΩ RESISTORS
TAPE PLAY
E12 LEFT
RIGHT E11
E6
OFF
PHONO
TAPE
FM
FM AFC
AM
STEREO MONO
E4
E5
E24
E25
LUG VIEW
CONN CABLE AND PLUGS FROM TUNER TO AMP
E3 PIN VIEW
E2
PHONO POWER
E7 MERCURY SWITCH
E20 COMP LIGHT
E18 FM LIGHT
E19 AM LIGHT
E27
E6 SWITCH SHOWN IN FM STEREO POSITION
AGC
PHONO MOTOR
E28
E29
E30
PIN VIEW
CONN CABLE AND PLUGS FROM TUNER TO PHONO
Q601 M4765 VOLTAGE REGULATOR
ZENER
E601
Q602 M4732 AGC AMP
E8 TUNING METER
RIGHT TAPE RECORD LEFT
E9
E10
Q501 M4733 TAPE PRE-AMP
Q502 M4733 1ST PRE-AMP
Q503 M4732 2ND PRE-AMP
Q504 M4732 3RD PRE-AMP
LEFT CHANNEL
C-536 .01 NOT IN CH CODED "E" & EARLIER
R-503 100Ω ON CH CODED "D" & EARLIER
LOUDNESS
Q505 M4733 TAPE PRE-AMP
E15 EXTENDED BASS
BALANCE
TREBLE
BASS
C-537 .01 NOT IN CH CODED "E" & EARLIER
R-520 100Ω ON CH CODED "D" & EARLIER
Q506 M4733 1ST PRE-AMP
Q507 M4732 2ND PRE-AMP
Q508 M4732 3RD PRE-AMP
RIGHT CHANNEL
E1 PIN VIEW
E23
LUG VIEW
E26 CONN CABLE AND PLUGS FROM TUNER TO AMP
CONTROLS NOT ON P.C. BOARD
REAR SECTION - RIGHT CHAN.
FRONT (PANEL) SECTION - LEFT CHAN.
BOT VIEW Q601 ONLY
BOT VIEW ALL TRANSISTORS EXCEPT Q601
SILICON
LOCATING DOT
BOT VIEW ALL T'S & ALL L'S EXCEPT T301, L301-2 & 3
DIAG.63E6300BA67-A

NOTES:
CAPACITORS-UNLESS OTHERWISE SPECIFIED, DECIMAL VALUES IN MF, ALL OTHERS IN PF.
VOLTAGES-MEASURED FROM POINT INDICATED TO GROUND WITH A VTVM+ 10% NO SIGNAL IN. VOL AT MIN.
AM RANGE 535KC TO 1620KC
FM RANGE 88MC TO 108MC
AM IF 455KC
FM IF 10.7MC
ALL RESISTORS ARE 1/4W 10% UNLESS OTHERWISE NOTED

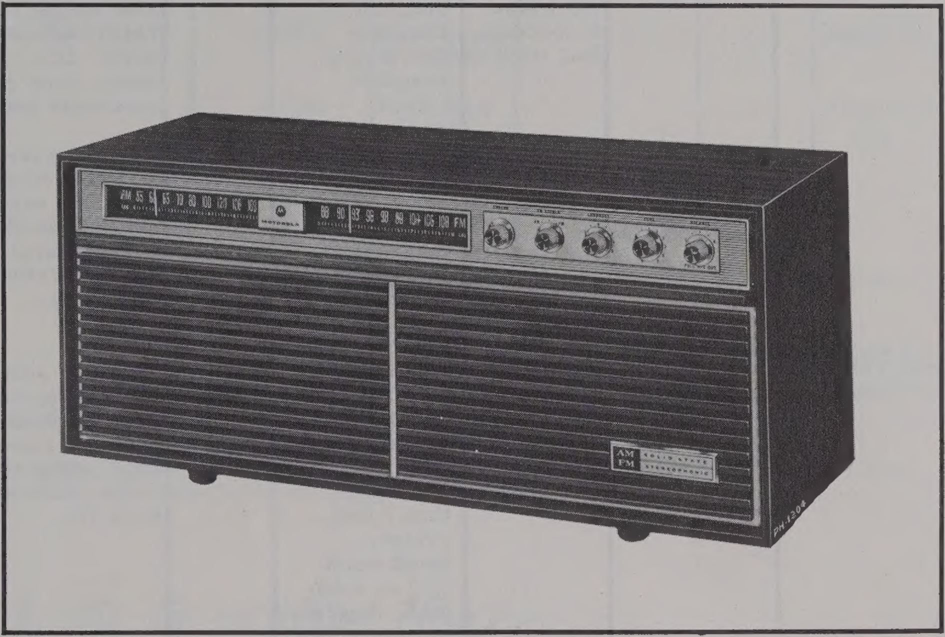
WHERE TWO VOLTAGES ARE SHOWN, UPPER VOLTAGE IS IN FM/FM AFC POSITION. LOWER VOLTAGE IS IN AM POSITION NO SIGNAL IN

SCHEMATIC DIAGRAM - HS-62257

stereo fm-am table radio **MANUAL 68P63011A10**

MODEL TT22C
CHASSIS HS-67206

MOTOROLA service manual



GENERAL INFORMATION

TYPE

Model TT22C is a solid state AM/FM monaural and FM stereo (multiplex) receiver. It features a tuned RF stage on AM and FM, AFC on FM, sixteen (16) transistors, twelve (12) diodes and a silicon rectifier.

The receiver has a built-in ferrite rod AM antenna and a line cord type FM antenna. Terminals on the back permit use of an outdoor FM antenna. When no outdoor antenna is used, reception of FM stations may be improved by removing the line cord clip from terminal A and connecting a 36" piece of insulated wire to the terminal.

ELECTRICAL SPECIFICATIONS

Power Requirements: The Model TT22C operates from a 120 volt line AC/DC and consumes approximately 25 watts.

Accessory Speakers: External speakers of eight (8) ohm impedance may be connected by use of the phono type jacks on the rear of the set. The internal speakers are disconnected when external speakers are plugged in.

SERVICE NOTES

CHASSIS REMOVAL

1. Disconnect line cord and leads or clip connected to antenna terminals.

2. Pull off five (5) front control knobs.

3. Remove six (6) small wood screws that fasten cabinet back.

4. Remove six (6) chassis screws from bottom of cabinet (recessed holes).

5. Remove four (4) hex head wood screws from lower edge of dial bracket rail.

CAUTION: Do not remove dial glass screws at center line of rail.

6. Slide chassis and dial bracket out of cabinet as an assembly.

7. Chassis is replaced in reverse order. Be sure speaker lead (phasing) wiring is correct and connect FM antenna leads to inside terminals on cabinet back.

NOTE: If dial glass or lamps have been removed, make sure lamps are carefully re-inserted in their wells. Particular caution should be observed when re-positioning the multiplex indicator lamp.

MOTOROLA INC. 9401 WEST GRAND AVENUE, FRANKLIN PARK, ILLINOIS
PART NO. 68P63011A10 3-67 PRICE 35 CENTS
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ALIGNMENT

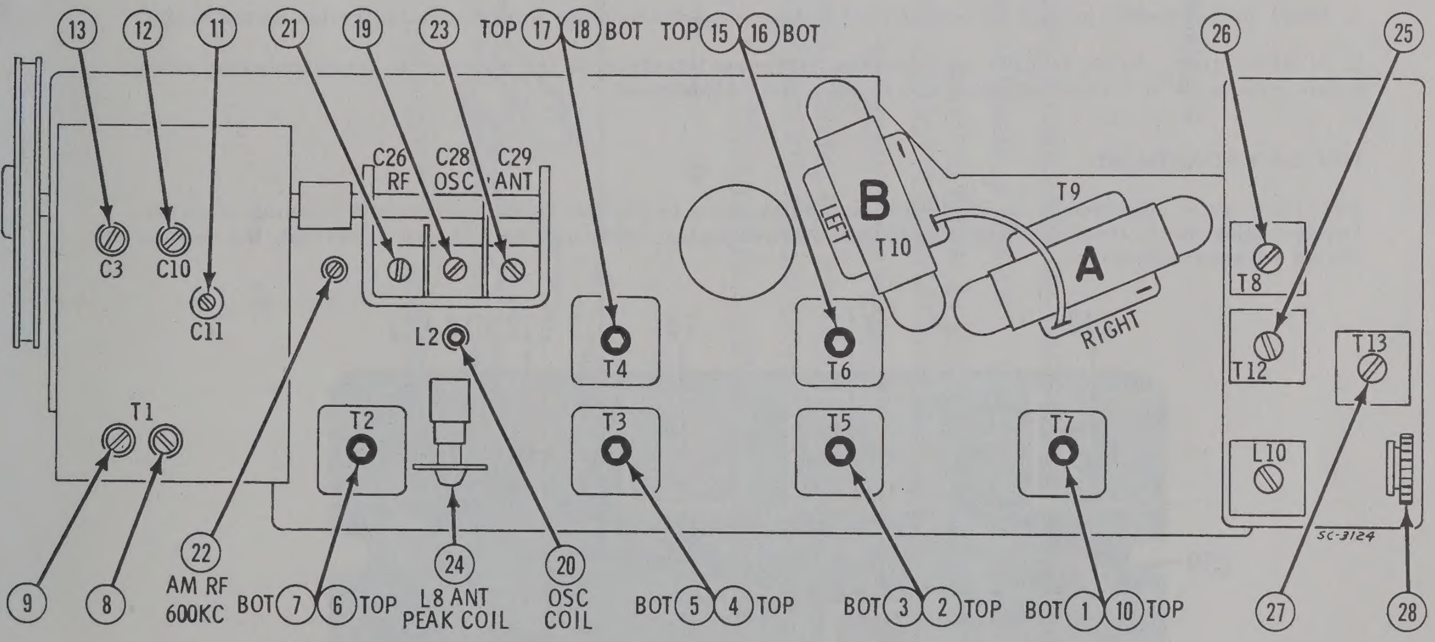
Either AM or FM alignment may be performed independently of the other. Use an AM signal generator, a VTVM and an output meter. Set the volume control to maximum and the AM-FM switch to AM for AM alignment and to FM for FM alignment. The AM antenna and speaker should be connected for alignment. Use insulated alignment tools. For FM alignment, use an unmodulated signal; for AM alignment, the signal should be modulated with 400CPS (see "Alignment Location Detail").

STEP	GENERATOR CONNECTION	GENERATOR FREQUENCY	TUNER SETTING	OUTPUT INDICATOR	ADJUST	REMARKS
FM-IF ALIGNMENT						
1.	Hot side of generator to base of Q-4 through .01 coupling capacitor	10.7Mc (No mod)	High end (tuning shaft rorated fully clockwise to mechanical stop).	VTVM DC probe to Point $\boxed{A}$ on schematic diagram. Decouple thru 1 meg resistor.	1, 2, 3, 4, 5, 6 & 7	Function switch must be in FM position. Adjust for maximum positive reading. Maintain generator output so that meter reads between 2 and 3 volts DC. Always use outer core position for maximum setting.
2.	"	10.7Mc (No mod)	"	VTVM DC probe to Point $\boxed{B}$ on schematic diagram. Decouple thru 1 meg resistor.	10	Adjust for zero reading on VTVM. A positive and negative reading will be obtained on either side of correct setting. (If meter has zero center scale, use this scale.)
3.	External FM antenna leads.	10.7Mc (No mod)	"	VTVM DC probe to Point $\boxed{A}$ on schematic diagram. Decouple thru 1 meg resistor. Short Point $\boxed{C}$ on schematic diagram to ground with a short jumper.	8 & 9	Function switch must be in FM position. Adjust for maximum positive reading. Maintain generator output so that meter reads between 2 and 3 volts DC.
4.	"	108.5Mc (No mod)	High end (tuning shaft rotated fully cloclwise to mechanical stop).	VTVM DC probe to Point $\boxed{A}$ on schematic diagram. Decouple thru 1 meg resistor. Short Point $\boxed{C}$ on schematic diagram to ground with a short jumper.	11	Adjust for maximum positive reading. Maintain generator output so that meter reads between 2 and 3 volts DC.
5.	"	98Mc (No mod)	Tuning gang tuned to 98Mc on dial scale.	VTVM DC probe to Point $\boxed{A}$ on schematic diagram. Decouple thru 1 meg resistor. Short Point $\boxed{C}$ on schematic diagram to ground with a short jumper.	12 & 13	Adjust for maximum positive reading. Maintain generator output so that meter reads between 2 and 3 volts DC.
AM-IF ALIGNMENT						
6.	Hot side of generator to base of Q-5 thru .01 capacitor.	455Kc	Gang fully opened.	Output meter across T-9 secondary.	15, 16, 17 & 18	Adjust for maximum.

ALIGNMENT (Cont'd)

STEP	GENERATOR CONNECTION	GENERATOR FREQUENCY	TUNER SETTING	OUTPUT INDICATOR	ADJUST	REMARKS
AM-OSC ALIGNMENT						
7.	Hot side of generator to base of Q-5 thru .01 capacitor.	1620Kc	Gang fully opened.	Output meter across T-9 secondary	19	Adjust for maximum.
8.	"	535Kc	Gang fully closed.	"	20	Adjust for maximum.
9.	Repeat Steps #7 and #8 until no further improvement.					
10.	Radiation loop*	1400Kc	Rock gang to 1400Kc	"	21	Adjust for maximum.
11.	"	600Kc	Rock gang to 600Kc	"	22	Adjust for maximum.
12.	Repeat Steps #10 and #11 until no further improvement.					
AM ANTENNA ALIGNMENT						
13.	Radiation loop*	1400Kc	Rock gang to 1400Kc	"	23	Adjust for maximum.
14.	"	600Kc	Rock gang to 600Kc	"	24	Adjust for maximum.
15.	Repeat Steps #13 and #14 until no further improvement.					

*Connect generator across 5" diameter, 5-turn loop and couple inductively to receiver loop. Keep radiation loop approximately 24" from receiver loop.


13
12
11
21
19
23
TOP 17 18 BOT
TOP 15 16 BOT
26
25
C26 RF
C28 OSC
C29 ANT
C3
C10
C11
B
LEFT
T10
T9
A
RIGHT
T8
T12
T13
L10
L2
T4
T6
T1
T2
T3
T5
T7
SC-3124
22
AM RF 600KC
9
8
BOT 7 6 TOP
24
L8 ANT PEAK COIL
20
OSC COIL
BOT 5 4 TOP
BOT 3 2 TOP
BOT 1 10 TOP
27
28

ALIGNMENT POINTS

FM STEREO ALIGNMENT PROCEDURE

NOTE: The multiplex section is factory aligned and is very stable under most shipping and handling conditions. Alignment is not required unless components have been replaced or tampering is suspected.

FM STEREO ALIGNMENT PROCEDURE (Cont'd on next page)

FM MULTIPLEX ALIGNMENT USING AN FM-STEREO STATION AIR SIGNAL

NOTE: Storecast traps cannot be easily aligned using an air signal. A generator should be used for trap alignment.

19Kc Pilot Carrier Channel Alignment And 38Kc Frequency Doubler Adjustment

1. Tune radio to a stereo FM broadcast. For best alignment conditions, the signal should be weak; if necessary, remove antenna twin lead from tuner.

2. Adjust T-12 and T-8 (alignment points #25 and #26) while viewing the stereo indicator light for maximum brilliance.

FM MULTIPLEX ALIGNMENT USING MOTOROLA STEREO-FM ALIGNER

The storecast traps provide attenuation in excess of 40 db at the 67Kc storecast sub-carrier frequency. Under normal conditions, they should require no service. They are carefully set at the factory and unless there is specific complaint of storecast interference, it is best not to include these traps in a routine alignment procedure.

19Kc Pilot Carrier Channel Alignment And 38Kc Frequency Doubler Adjustment

1. Connect an oscilloscope using a low capacity probe to the junction of E-12 and E-13.

2. Disconnect the lead between C-59 and R-35.

3. Set the Motorola Stereo-FM Aligner to 19Kc and connect to the junction of C-59 and C-71.

4. Tune T-12 and transformer T-8 (alignment points #25 and #26) for maximum indication on the oscilloscope. Maintain output level of stereo aligner so that oscilloscope reads approximately 4 volts peak to peak.

TO ALIGN STORECAST TRAPS

1. Connect an oscilloscope using a low capacity probe to the junction of E-12 and E-13.

2. Disconnect the lead between C-59 and R-35.

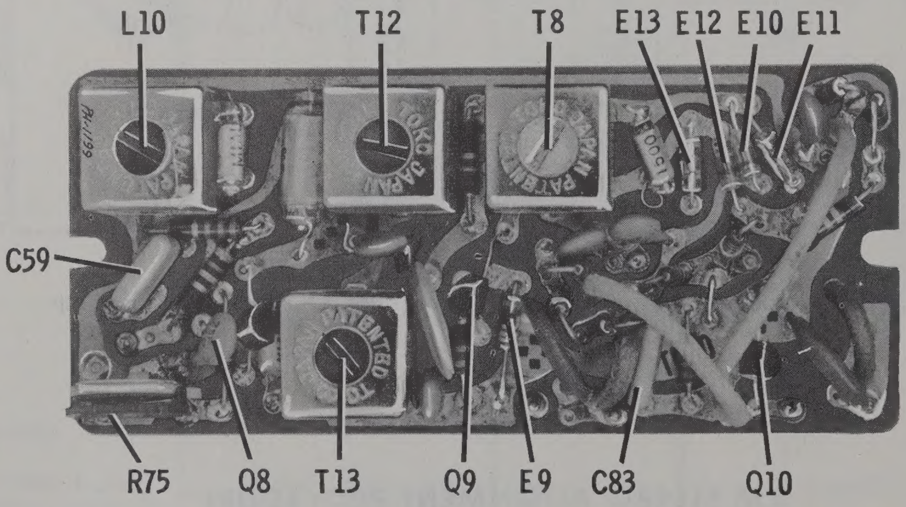
3. Set the Motorola Stere-FM Aligner to SCA.

4. Short out L-10 with a jumper and adjust T-13 (alignment point #27) for a minimum indication on the scope.

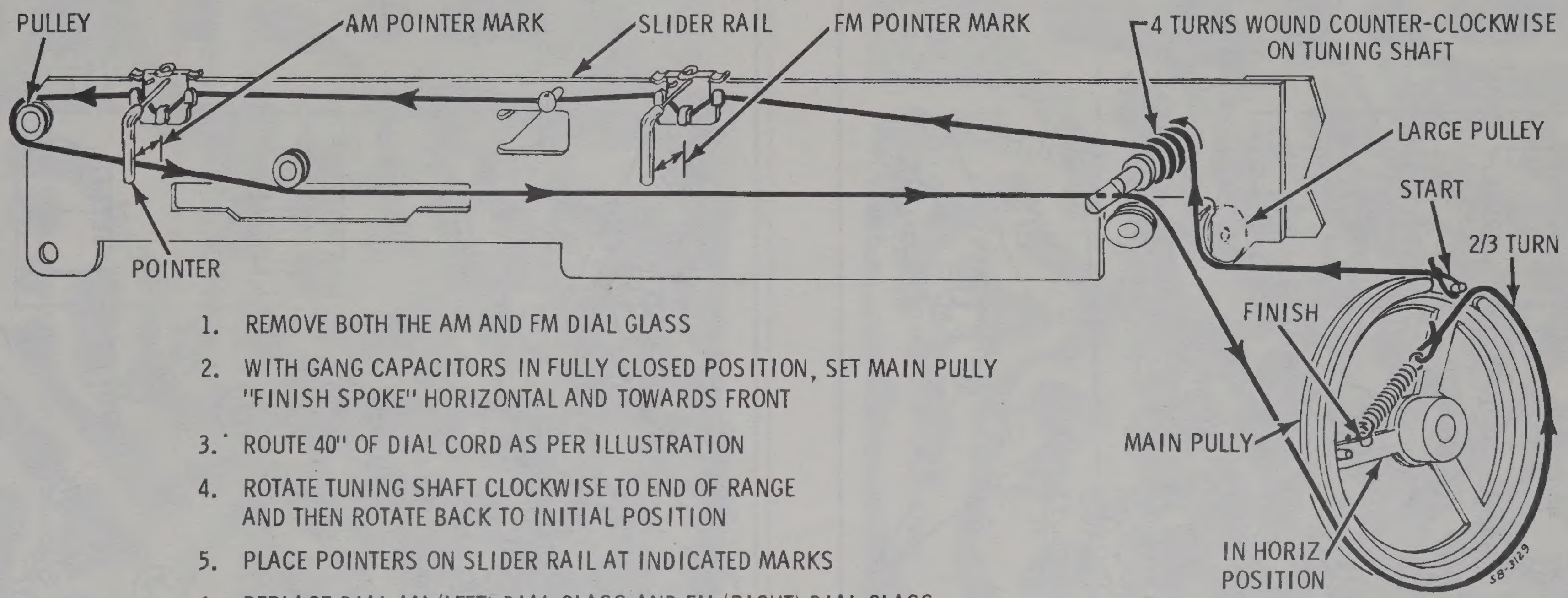
5. A 53Mc trap, L-10, is used to minimize storecast interference (or whisper) in locations using store music outlets. It is factory adjusted and is not a field adjustment.

19KC GAIN ADJUSTMENT

The 19Kc gain adjustment, R-75 (alignment point #28), is pre-set by the factory and normally does not require adjustment. However, if the stereo indicator lamp glows very dim on a stereo broadcast, the control can be advanced clockwise.

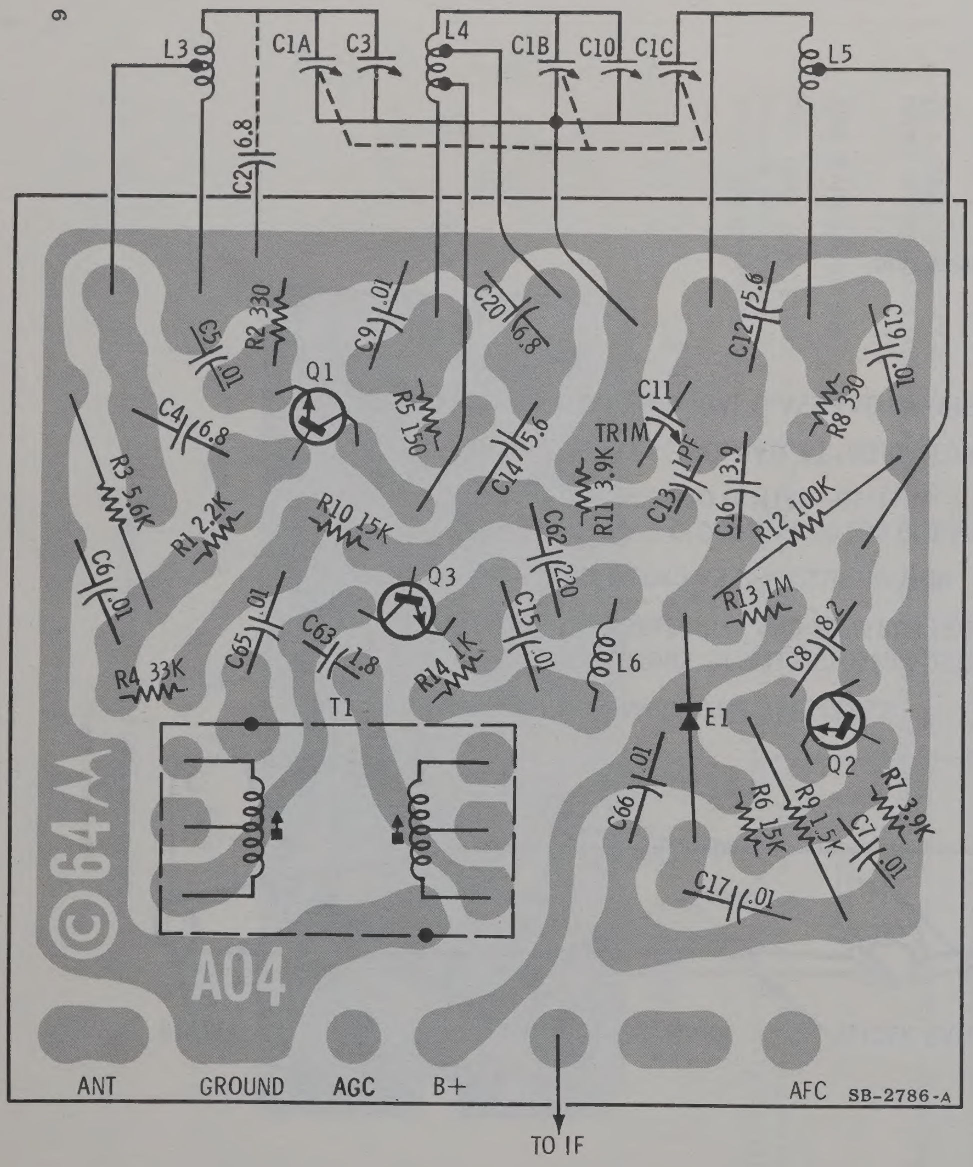


MULTIPLEX BOARD PARTS LOCATION


PULLEY
AM POINTER MARK
SLIDER RAIL
FM POINTER MARK
4 TURNS WOUND COUNTER-CLOCKWISE ON TUNING SHAFT
LARGE PULLEY
START
2/3 TURN
POINTER
FINISH
MAIN PULLY
IN HORIZ POSITION
SB-3129

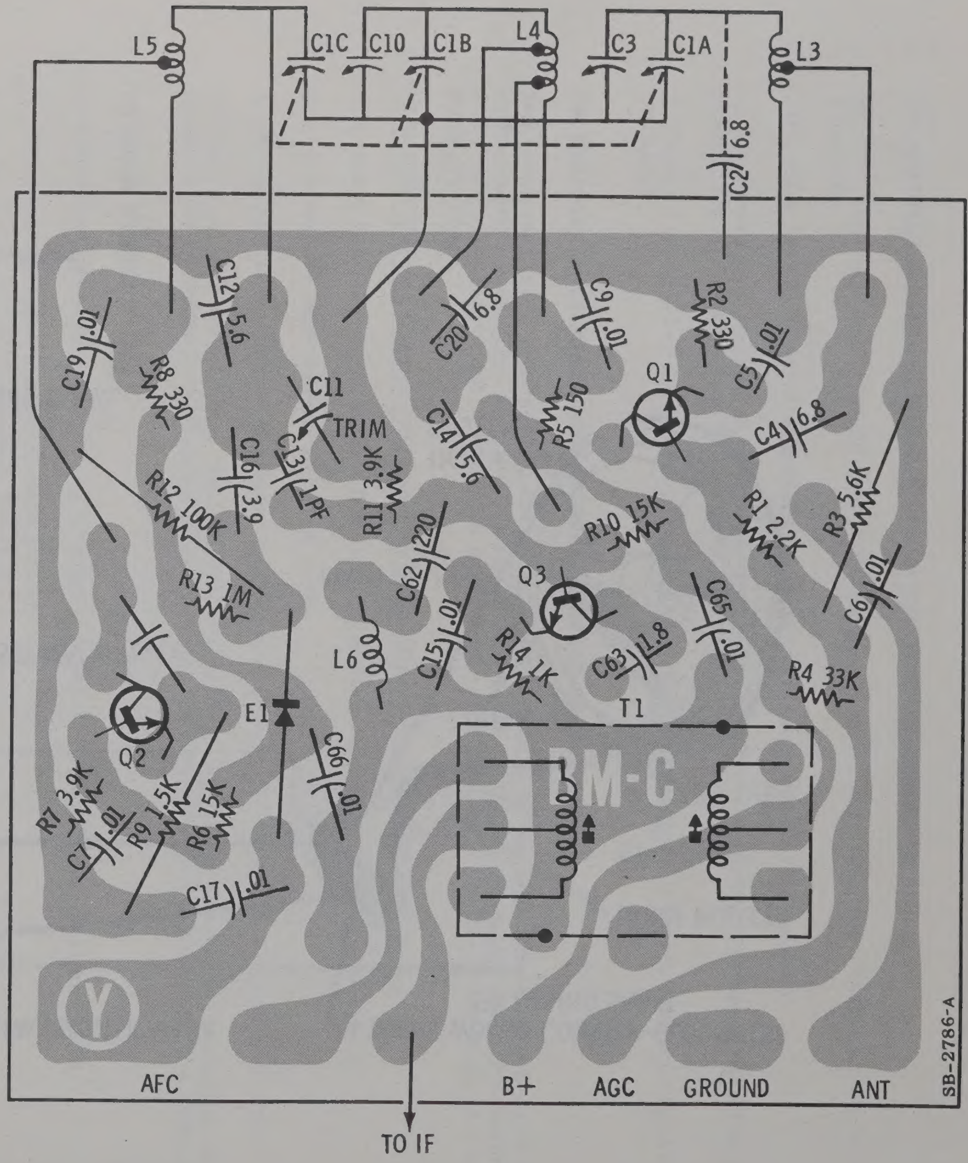
1. REMOVE BOTH THE AM AND FM DIAL GLASS
2. WITH GANG CAPACITORS IN FULLY CLOSED POSITION, SET MAIN PULLY "FINISH SPOKE" HORIZONTAL AND TOWARDS FRONT
3. ROUTE 40" OF DIAL CORD AS PER ILLUSTRATION
4. ROTATE TUNING SHAFT CLOCKWISE TO END OF RANGE AND THEN ROTATE BACK TO INITIAL POSITION
5. PLACE POINTERS ON SLIDER RAIL AT INDICATED MARKS
6. REPLACE DIAL AM (LEFT) DIAL GLASS AND FM (RIGHT) DIAL GLASS

DIAL STRINGING DETAIL


L3
C1A
C3
L4
C1B
C10
C1C
L5
C2 6.8
R2 330
C5 .01
C9 .01
C20 6.8
C12 5.6
C19 .01
Q1
C4 6.8
R5 150
C14 5.6
C11
TRIM
C13 1PF
C16 3.9
R8 330
R3 5.6K
R1 2.2K
R10 15K
R11 3.9K
C62 220
R12 100K
C6 .01
Q3
C15 .01
R13 1M
C65 .01
C63 1.8
R14 1K
L6
C8 8.2
R4 33K
T1
E1
Q2
C66 .01
R6 15K
R9 1.5K
R7 3.9K
C7 .01
C17 .01
©64 M
A04
ANT
GROUND
AGC
B+
AFC
SB-2786-A
TO IF

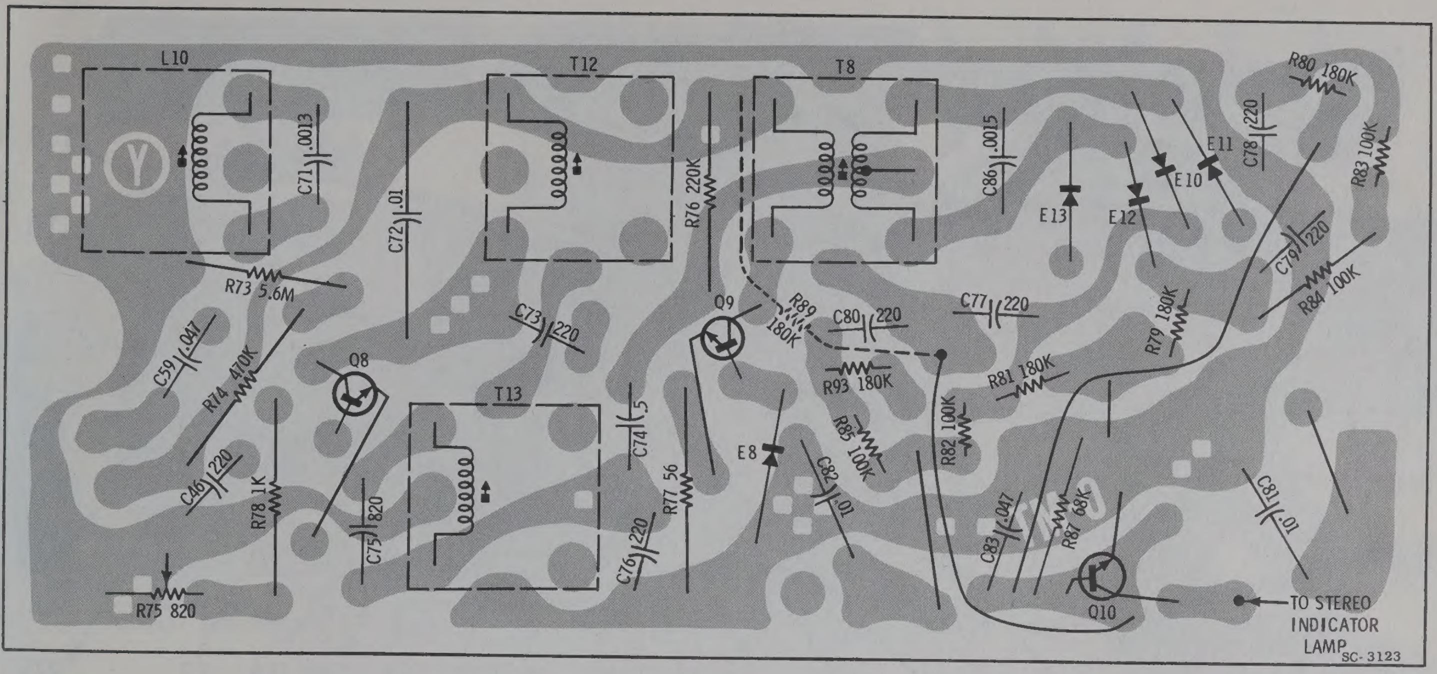
TOP VIEW

FM RF PLATED BOARD (PART OF CHASSIS HS-67206)


L5
C1C
C10
C1B
L4
C3
C1A
L3
C2 6.8
C12 5.6
C19 .01
C20 6.8
C9 .01
R2 330
C5 .01
R8 330
C11
TRIM
C14 5.6
R5 150
Q1
C4 6.8
C16 3.9
C13 1PF
R11 3.9K
R12 100K
R10 15K
R1 2.2K
R3 5.6K
C62 220
Q3
R13 1M
C65 .01
C6 .01
L6
C15 .01
R14 1K
C63 1.8
R4 33K
T1
E1
Q2
C66 .01
DM-C
R7 3.9K
C7 .01
R9 1.5K
R6 15K
C17 .01
Y
AFC
B+
AGC
GROUND
ANT
SB-2786-A
TO IF

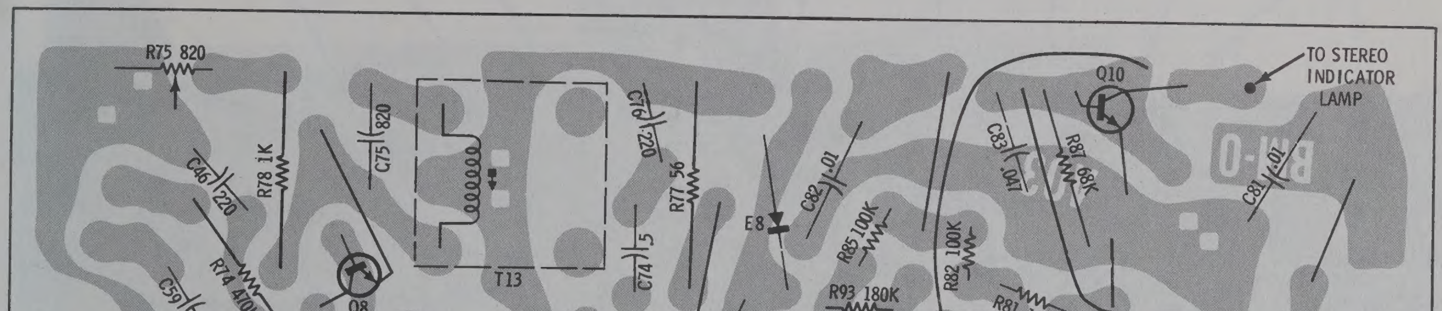
BOTTOM VIEW

FM-RF PLATED BOARD (PART OF CHASSIS HS-67206)


L10
T12
T8
R80 180K
C71 .0013
C72 .01
R76 220K
C86 .0015
C78 220
R83 100K
E13
E12
E10
E11
R73 5.6M
C79 220
R84 100K
Q9
R89 180K
C80 220
C77 220
C73 220
R79 180K
C59 .047
Q8
R74 470K
R93 180K
R81 180K
T13
C74 .5
R85 100K
R82 100K
C46 220
E8
C82 .01
R78 1K
R77 56
C83 .047
R87 68K
C81 .01
C75 820
C76 220
Q10
R75 820
TO STEREO INDICATOR LAMP
SC-3123

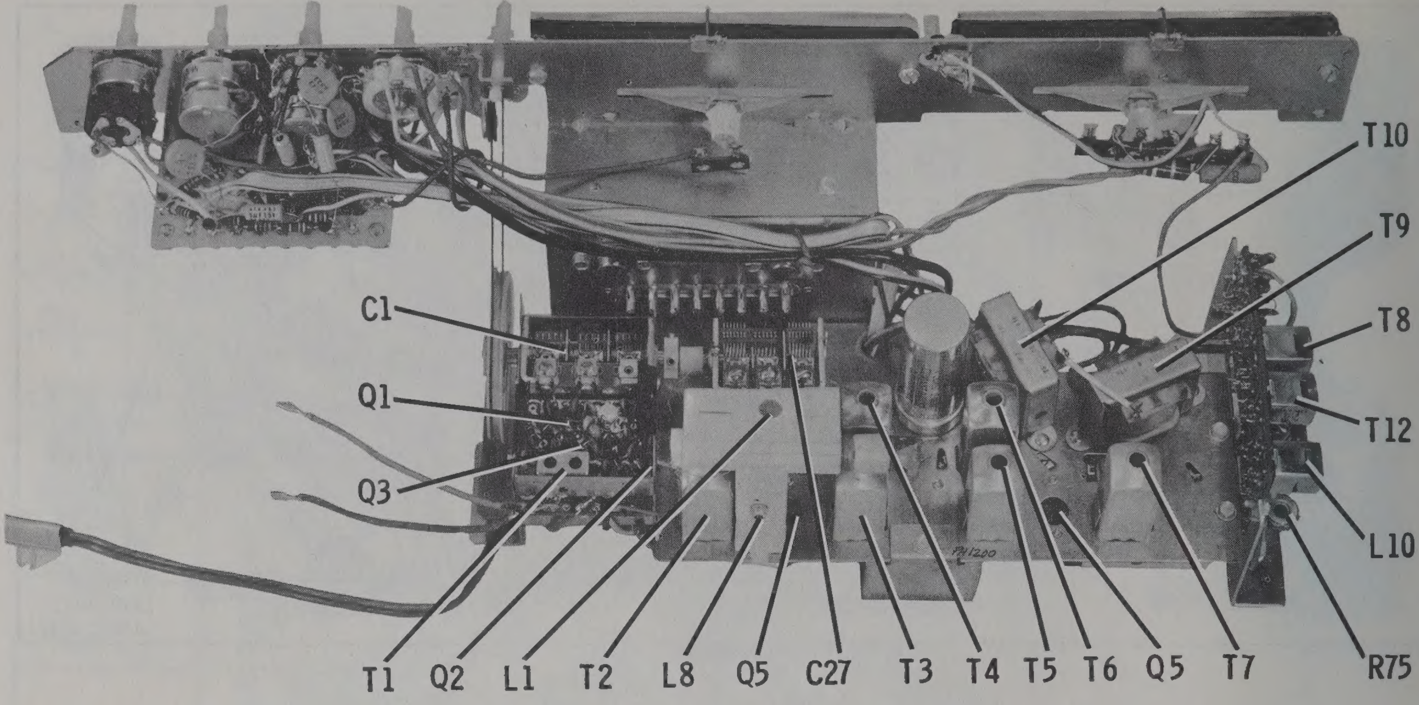
TOP VIEW

MULTIPLEX CIRCUIT BOARD (PART OF HS-67206)

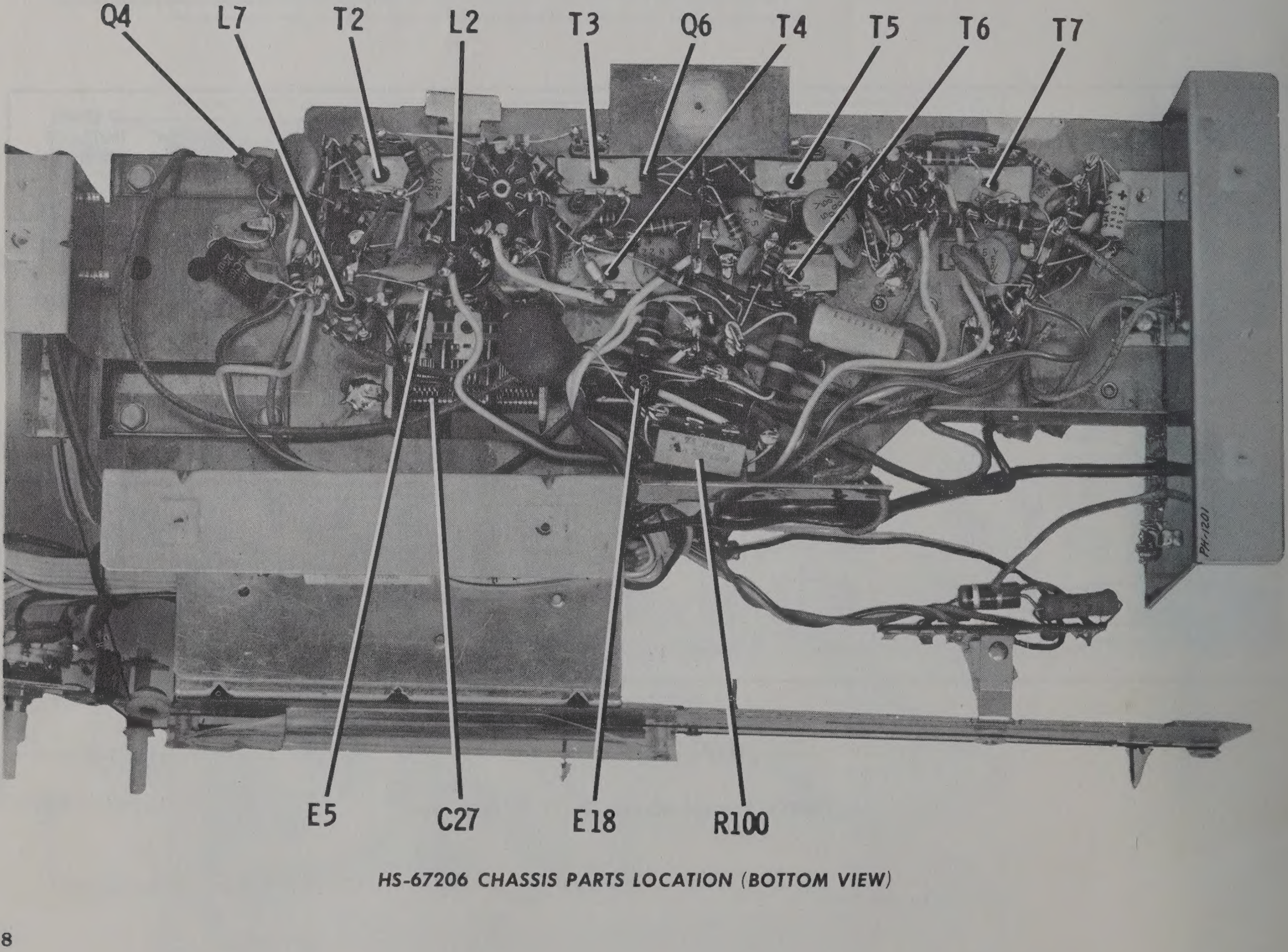

R75 820
Q10
TO STEREO INDICATOR LAMP
C75 820
C76 220
C83 .047
R87 68K
C46 220
R78 1K
T13
R77 56
E8
C82 .01
R85 100K
C81 .01
C74 .5
R82 100K
C59 .047
R74 470K
Q8
R93 180K
R81 180K
C73 220
R89 180K
C80 220
C77 220
R79 180K
Q9
R73 5.6M
R84 100K
C79 220
C72 .01
R76 220K
E13
E12
C71 .0013
C86 .0015
E10
E11
R83 100K
C78 220
L10
T12
T8
R80 180K
SC-3123

BOTTOM VIEW

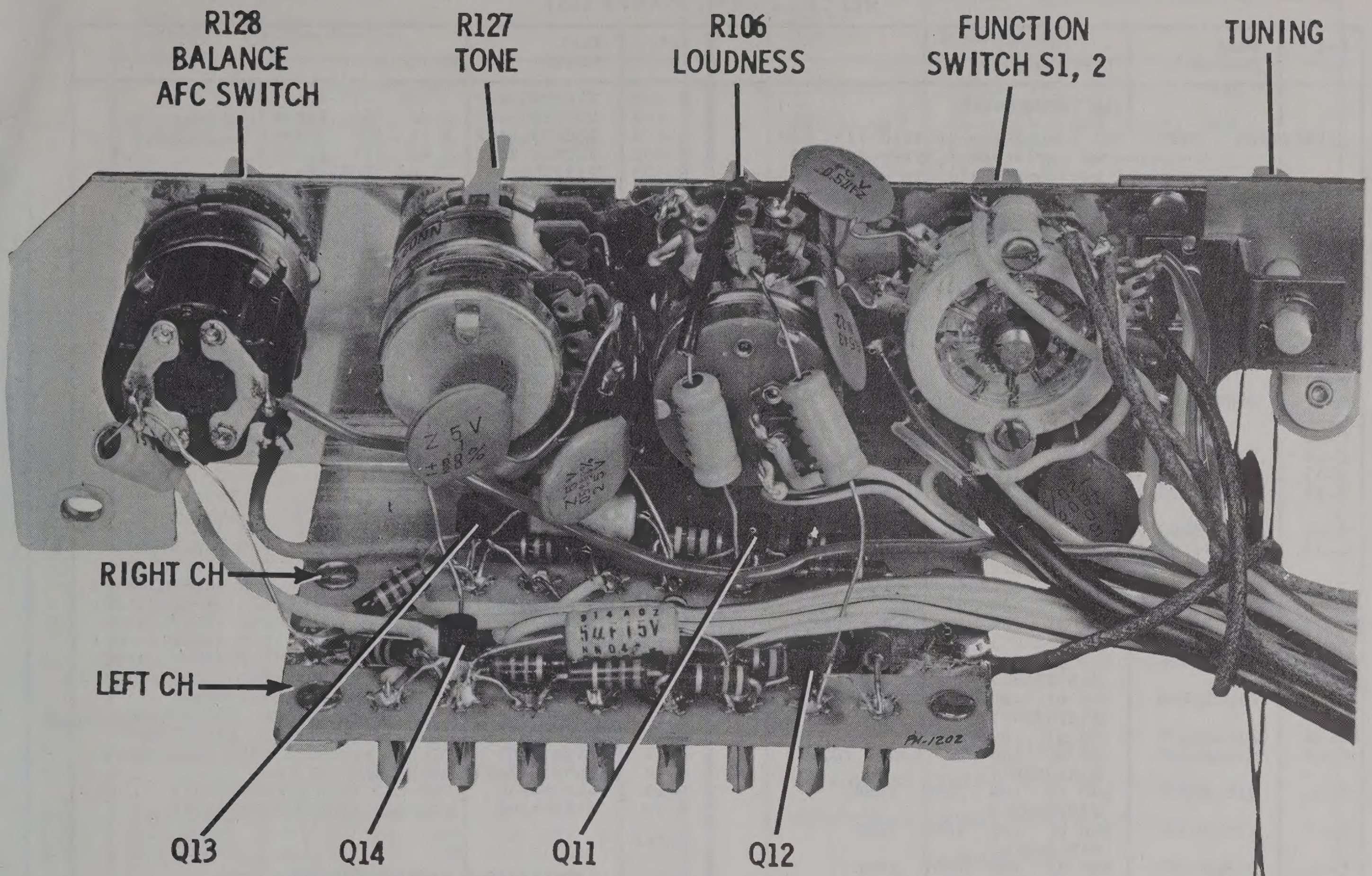
MULTIPLEX CIRCUIT BOARD (PART OF HS-67206)


T10
T9
T8
T12
L10
R75
C1
Q1
Q3
T1
Q2
L1
T2
L8
Q5
C27
T3
T4
T5
T6
Q5
T7
PH1200

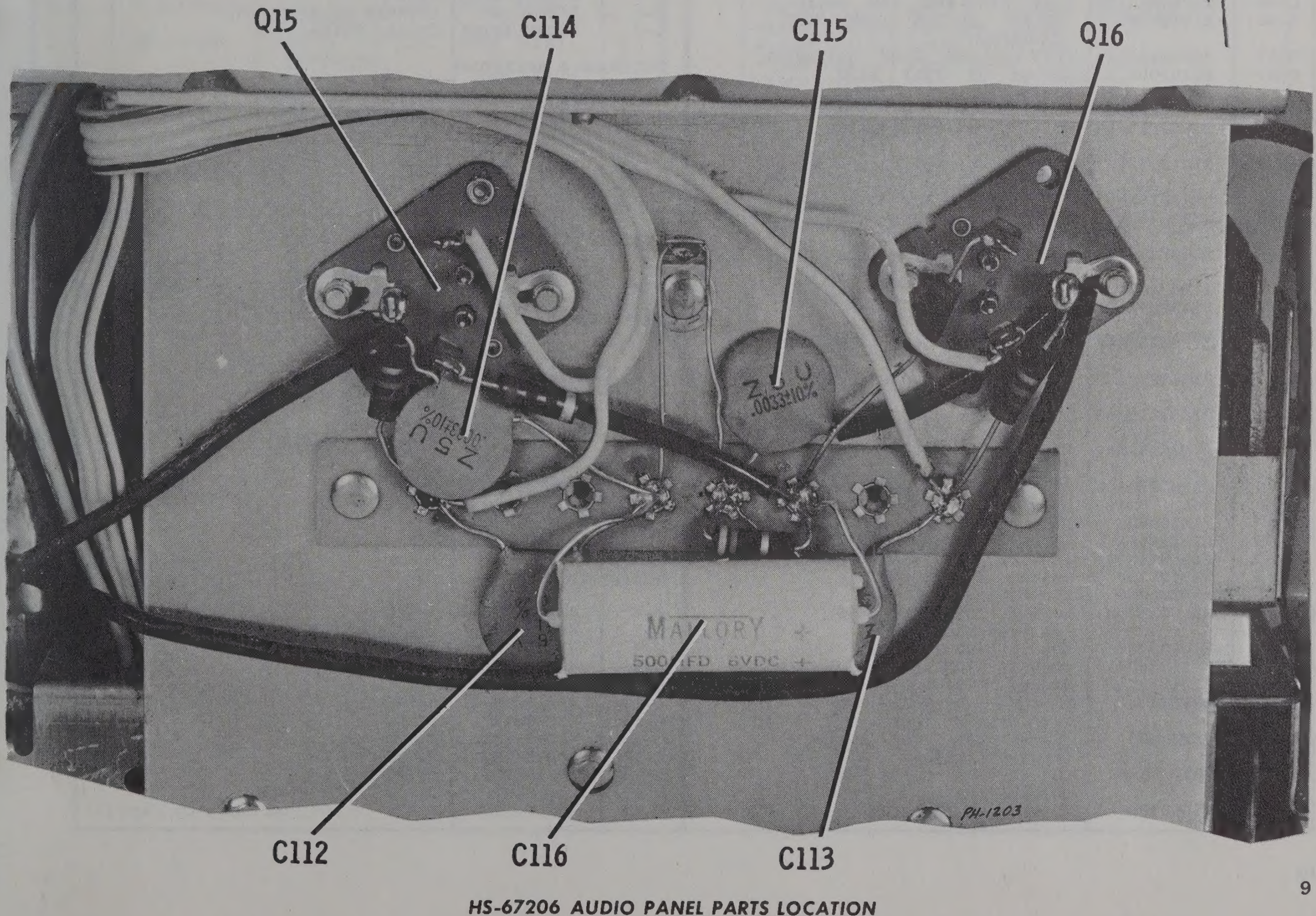
HS-67206 CHASSIS PARTS LOCATION (TOP VIEW)


Q4
L7
T2
L2
T3
Q6
T4
T5
T6
T7
PH-1201
E5
C27
E18
R100

HS-67206 CHASSIS PARTS LOCATION (BOTTOM VIEW)


R128
BALANCE
AFC SWITCH
R127
TONE
R106
LOUDNESS
FUNCTION
SWITCH S1, 2
TUNING
RIGHT CH
LEFT CH
PH-1202
Q13
Q14
Q11
Q12

HS-67206 CONTROL BRACKET PARTS LOCATION


Q15
C114
C115
Q16
MALLORY
500 MFD 6VDC
PH-1203
C112
C116
C113

HS-67206 AUDIO PANEL PARTS LOCATION

REPLACEMENT PARTS LIST

Ref. No.	Part Number	Description
		ELECTRICAL PARTS
CAPACITORS - NOTE:		The capacitors in this list are recommended replacement types for the original equipment; all are ceramic disc type unless otherwise specified.
C-18	21S135299	.01 mf +80-20% 100V (USE 21S135297)
C-21	21S134166	.22 pf 10% 500V CER TUB (USE 21K747200)
C-22	21S135296	.05 mf +80-20% 25V
C-23	21S135299	.01 mf +80-20% 100V (USE 21S135297)
C-24	*21S134387	.001 mf +100-0% 500V
C-26	---	PART OF C-27
C-27	19C63152A01	VARIABLE, 3-sect: AM
C-28	---	PART OF C-27
C-29	---	PART OF C-27
C-30	21S135296	.05 mf +80-20% 25V
C-31	21S115962	.47 pf 10% 500V CER TUB
C-32	21S135299	.01 mf +80-20% 100V (USE 21S135297)
C-33	21S135296	.05 mf +80-20% 25V
C-34	21S134166	.22 pf 10% 500V CER TUB (USE 21K747200)
C-35	21D62461A04	.5 mf +80-20% 10V
C-36	21S135296	.05 mf +80-20% 25V
C-37	21S135299	.01 mf +80-20% 100V (USE 21S135297)
C-38	21S122455	3.9 pf 5% 500V NPO (USE 21S180A85)
C-40	21S135299	.01 mf +80-20% 100V (USE 21S135297)
C-42	21S135296	.05 mf +80-20% 25V
C-43	21S135299	.01 mf +80-20% 100V (USE 21S135297)
C-44	21S135303	220 pf 10% 100V (USE 21S180B28)
C-45	21S135303	220 pf 10% 100V (USE 21S180B28)
C-46	21S135303	220 pf 10% 100V (USE 21S180B28)
C-47	23C62914A02	5 mf 15V lytic
C-48	23C43280A22	1 mf +100-20% 10V lytic
C-55	21S135299	.01 mf +80-20% 100V (USE 21S135297)
C-59	8S10221A02	.047 mf 20% 250V polyester
C-67	8S10100A14	390 pf 5% 125V N150 polystyrene
C-68	8S10226A03	1500 pf 5% 25V N150 Polystyrene
C-69	23C62914A06	25 mf 15V lytic (USE 23C543075)
C-70	21S135299	.01 mf +80-20% 100V (USE 21S135297)
C-71	8S10226A10	1300 pf 5% 33V N150 polystyrene
C-72	8S10226A07	10000 pf 5% 63V N150 polystyrene
C-73	21C62258A02	220 pf 10% 500V (USE 21R132503)
C-74	21D62461A07	.5 mf 10% 10V
C-75	8S10226A09	820 pf 5% 33V N150 polystyrene
C-76	21C62258A02	220 pf 10% 500V (USE 21R132503)
C-77	21C62258A02	220 pf 10% 500V (USE 21R132503)
C-78	21C62258A02	220 pf 10% 500V (USE 21R132503)
C-79	21C62258A02	220 pf 10% 500V (USE 21R132503)
C-80	21C62258A02	220 pf 10% 500V (USE 21R132503)
C-81	21S135658	.01 mf +80-20% Z5U 100V
C-82	21S135658	.01 mf +80-20% Z5U 100V
C-83	8S10221A02	.047 mf 20% 250V polyester
C-84	21S135296	.05 mf +80-20% 25V
C-85	21S135296	.05 mf +80-20% 25V
C-86	8S10226A03	1500 pf 5% 25V N150 polystyrene
C-87	21S135296	.05 mf +80-20% 25V
C-94	21S128634	.005 mf 10% 500V
C-95	21S135311	470 pf 10% 100V
C-100	*23K648082	150 mf-150V; 80 mf-25V; 250 mf-25V lytic
C-101	8S131900	.05 mf 20% 400V mylar (USE 8R128690)
C-102	23K647828	100 mf 15V lytic (USE 23D543074)
C-103	21D62461A04	.5 mf +80-20% 10V

Ref. No.	Part Number	Description
C-104	21D62461A04	.5 mf +80-20% 10V
C-105	23C62914A02	5 mf 15V lytic
C-106	23C62914A02	5 mf 15V lytic
C-107	23C62914A02	5 mf 15V lytic
C-108	21S135295	.1 mf 20% 25V
C-109	23C62914A02	5 mf 15V lytic
C-110	21S135295	.1 mf 20% 25V
C-111	23C62914A02	5 mf 15V lytic
C-112	21S135295	.1 mf 20% 25V
C-113	21S135295	.1 mf 20% 25V
C-114	21S135300	.0033 mf 10% 500V
C-115	21S135300	.0033 mf 10% 500V
C-116	*23C62914A13	500 mf -10+150% 6V lytic
C-117	21S135295	.1 mf 20% 25V
C-118	21S135295	.1 mf 20% 25V
C-119	23C43280A22	1 mf +100-20% 10V lytic
C-120	23K647828	100 mf 15V lytic (USE 23D543074)
MISCELLANEOUS ELECTRICAL PARTS		
E-2	48D63590A01	DIODE, crystal
E-3	48D63590A01	DIODE, crystal
E-5	48K644681	DIODE, crystal (USE 48R134587)
E-6	48K644681	DIODE, crystal (USE 48R134587)
E-7	48K644681	DIODE, crystal (USE 48R134587)
E-8	48B62334A01	DIODE, crystal (USE 48B62334A02)
E-9	48B62334A01	DIODE, crystal (USE 48B62334A02)
E-10	48B62334A01	DIODE, crystal (USE 48B62334A02)
E-11	48B62334A01	DIODE, crystal (USE 48B62334A02)
E-12	48B62334A01	DIODE, crystal (USE 48B62334A02)
E-13	48B62334A01	DIODE, crystal (USE 48B62334A02)
E-14	65S134388	BULB, stereo: 10V-100EFC
E-15	*65S135615	BULB, dial: AM-FM: 24V-200EFC
E-16	65S135615	BULB, dial: AM-FM: 24V-200EFC
E-17	48K644681	DIODE, crystal: (USE 48R134587)
E-18	48S10062A05	RECTIFIER, silicon
E-19	51K754068	RES-CAP (USE 51C67517A01)
E-20	51K754068	RES-CAP (USE 51C67517A01)
COILS		
L-1	24B61746A04	ANTENNA, ferrite core
L-2	24C63348A02	OSCILLATOR
L-7	24C63196A01	AM-RF
L-8	24K648129	ANTENNA PEAKING COIL
L-9	24C61620A03	CHOKE, filter
CONTROLS & RESISTORS		
R-75	18B63499A01	CONTROL, gain
R-90	17K751479	4.7K 10% 3W
R-100	*17S135732	120 10% 5W
R-104		3.9K 10% 2W
R-106	*18D63155A02	CONTROL, on-off & loudness
R-127	*18D63155A03	CONTROL, tone
R-128	*18D63155A01	CONTROL, balance
SWITCH		
S-1, S-2	*40C60279B01	SWITCH, rotary: AM-FM-STEREO
TRANSFORMERS		
T-2	24C63304A01	IF: 10.7MC
T-3	24C63304A01	IF: 10.7MC
T-4	24D63346A03	IF: 455KC
T-5	24C63304A01	IF: 10.7MC
T-6	24D63346A02	IF: 455KC
T-7	24C63345A01	RATIO DETECTOR
T-8	24C63463A02	MX
T-9	*25D63503A06	OUTPUT
T-10	25D63503A06	OUTPUT
T-11	24C63463A01	MX
T-12	24C63463A01	MX
T-13	24C63463A01	MX
TRANSISTORS		
Q-4	48S134826	M4826
Q-5	48S134826	M4826
Q-6	48S134826	M4826
Q-8	48S134906	A1J
Q-9	48S134906	A1J
Q-10	48S134768	M4768
Q-11	48S134732	M4732
Q-12	48S134732	M4732
Q-13	48S134732	M4732
Q-14	48S134732	M4732
Q-15	48S134872	M4872
Q-16	48S134872	M4872

Parts List Cont'd On Page 13

L3
RED
E19
470
470K
A

	Part Number	Description
		MECHANICAL PARTS
	*64B60025B01	BACKGROUND, dial
	1V63057A93	BOARD, plated MX: incl plugs (USE 84C63581A03)
	42A61128A01	CLAMP, FM ant
	*30K648096	CORD, AC line
	58C60014B01	COUPLER, nylon: var cap coupling
	5K753143	GROMMENT, screw: chassis mtg
	14A63948A01	INSULATOR, trans
	9C66402A01	LUG, terminal: spkr leads
	2S7051	NUT, hex: 3/8-32 (cont mtg)
	2A60232A01	NUT, speed: dial scale ret
	*52B60026B01	POINTER, dial: AM-FM
	49B63340A01	PULLEY, tuning: lge
	*34D60028B02	SCALE, dial: AM
	*34D60028B01	SCALE, dial: FM
	3S131448	SCREW, tpg: #6-20 x 3/8 (trans mtg)
	47B63275A02	SHAFT, extension: controls (USE 47B63275A01)
	47A62533A01	SHAFT, tuning
	9B63949A01	SOCKET, power trans
	9S10174A05	SOCKET, tube: lam: 7 pin (USE 9S119871)
	9S10174A06	SOCKET, tube: lam: 7 pin: W/center shield (USE 9S119871)
	41A471681	SPRING, compression: tuning pulley
	4K501364	WASHER, "C": tuning shaft
	HT6 FM TUNER (PARTS OF HS-67206)	
		ELECTRICAL PARTS
CAPACITORS -	NOTE: The capacitors in this list are recommended replacement types for the original equipment; all are ceramic disc type unless otherwise specified.	
C-1	19C63264A02	VARIABLE, 3 sect: FM
C-2	21S120157	6.8 pf 10% 500V CER TUB
C-4	21S135307	6.8 pf .5% 100V NPO (USE 21S127024)
C-5	21S135306	.01 mf +50-20% 100V (USE 21S135304)
C-6	21S135306	.01 mf +50-20% 100V (USE 21S135304)
C-7	21S135306	.01 mf +50-20% 100V (USE 21S135304)
C-8	21S135458	8.2 pf .5% 100V NPO (USE 21S132305)
C-9	21S135306	.01 mf +50-20% 100V (USE 21S135304)
C-11	20B64388A01	TRIMMER, 3.5 to 13 pf
C-12	21S135308	5.6 pf .5% 100V NPO (USE 21R122173)
C-13	21S10167A02	1.0 pf 5% 500V CER TUB
C-14	21S135308	5.6 pf .5% 100V NPO (USE 21R122173)
C-15	21S135306	.01 mf +50-20% 100V (USE 21S135304)
C-16	21S135339	3.9 pf .25% 100V NPO (USE 21S180A85)

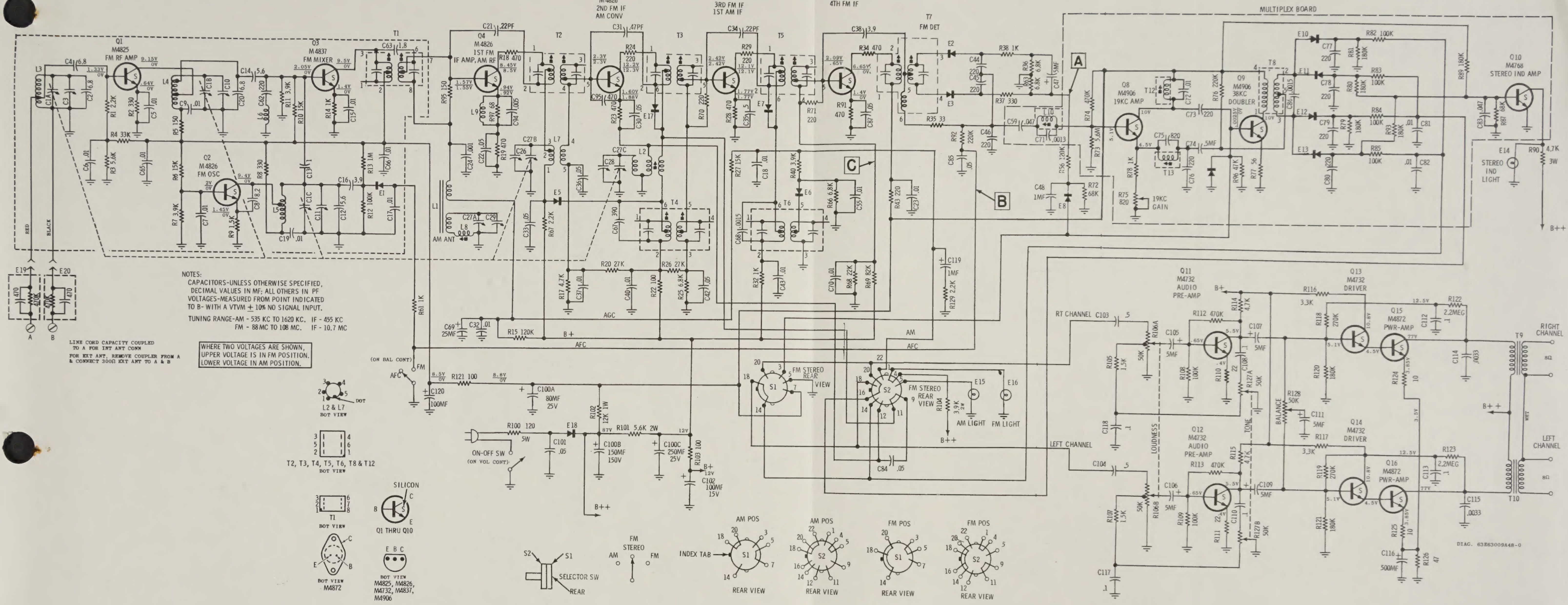
Ref. No.	Part Number	Description
C-17	21S135306	.01 mf +50-20% 100V (USE 21S135304)
C-19	21S135306	.01 mf +50-20% 100V (USE 21S135304)
C-20	21S135307	6.8 pf .5% 100V NPO (USE 21S127024)
C-62	21S135310	220 pf 5% 100V (USE 21S180B28)
C-63	21S115961	1.8 pf 10% 500V
C-65	21S135306	.01 mf +50-20% 100V (USE 21S135304)
C-66	21S135306	.01 mf +50-20% 100V (USE 21S135304)
MISCELLANEOUS ELECTRICAL PARTS		
E-1	48B63494A01	DIODE, volt var cap
COILS & CHOKES		
L-3	24C63465A02	FM: ant
L-4	24C63465A02	FM: RF
L-5	24C63465A04	FM: osc
L-6	24B62587A01	CHOKE
TRANSFORMER		
T-1	24C62338A01	IF: 10.7MC
TRANSISTORS		
Q-1	48S134825	M4825
Q-2	48S134826	M4826
Q-3	48S134837	M4837
		MECHANICAL PARTS
	77U63040A30	TUNER, HT-6 FM: complete
	84C63497A04	BOARD, plated chassis
		CABINET PARTS
	*13P63028A33	BEZEL & NAMEPLATE: "Stereophonic - Solid State"
	75C61074A03	BUMPER, cabinet: cab bott
	*16E63136A02	CABINET, table
	*15D63159A01	COVER, back: cab
	*13D63160A01	ESCUTCHEON, controls
	*36C60088B05	KNOB, control: bal
	*36C60088B06	KNOB, control: on-off & loud
	*36C60088B08	KNOB, switch
	*36C60088B07	KNOB, control: tone
	*36C60088B04	KNOB, control: tuning
	2S10080A07	NUT, pal: spkr mtg
	*13A60029B01	OVERLAY, escut: Motorola
	9A620836	RECEPTACLE, ext spkrs
	9C66402A01	RECEPTACLE, lug: spkr leads (USE 9C66402A05)
	*47B60030B01	ROD, light cond: multiplex
E-21	*50D63167A01	SPEAKER, 5 x 7; PM
E-22	50D63167A01	SPEAKER, 5 x 7; PM

*DENOTES NEW ITEM APPEARING IN ANY LIST FOR FIRST TIME.

REPLACEMENT PARTS LIST

Ref. No.	Part Number	Description
		ELECTRICAL PARTS
CAPACITORS - NOTE: The capacitors in this list are recommended replacement types for the original equipment; all are ceramic disc type unless otherwise specified.		
C-18	21S135299	.01 mf +80-20% 100V (USE 21S135297)
C-21	21S134166	.22 pf 10% 500V CER TUB (USE 21K747200)
C-22	21S135296	.05 mf +80-20% 25V
C-23	21S135299	.01 mf +80-20% 100V (USE 21S135297)
C-24	*21S134387	.001 mf +100-0% 500V
C-26	---	PART OF C-27
C-27	19C63152A01	VARIABLE, 3-sect: AM
C-28	---	PART OF C-27
C-29	---	PART OF C-27
C-30	21S135296	.05 mf +80-20% 25V
C-31	21S115962	.47 pf 10% 500V CER TUB
C-32	21S135299	.01 mf +80-20% 100V (USE 21S135297)
C-33	21S135296	.05 mf +80-20% 25V
C-34	21S134166	.22 pf 10% 500V CER TUB (USE 21K747200)
C-35	21D62461A04	.5 mf +80-20% 10V
C-36	21S135296	.05 mf +80-20% 25V
C-37	21S135299	.01 mf +80-20% 100V (USE 21S135297)
C-38	21S122455	3.9 pf 5% 500V NPO (USE 21S180A85)
C-40	21S135299	.01 mf +80-20% 100V (USE 21S135297)
C-42	21S135296	.05 mf +80-20% 25V
C-43	21S135299	.01 mf +80-20% 100V (USE 21S135297)
C-44	21S135303	220 pf 10% 100V (USE 21S180B28)
C-45	21S135303	220 pf 10% 100V (USE 21S180B28)
C-46	21S135303	220 pf 10% 100V (USE 21S180B28)
C-47	23C62914A02	5 mf 15V lytic
C-48	23C43280A22	1 mf +100-20% 10V lytic
C-55	21S135299	.01 mf +80-20% 100V (USE 21S135297)
C-59	8S10221A02	.047 mf 20% 250V polyester
C-67	8S10100A14	390 pf 5% 125V N150 polystyrene
C-68	8S10226A03	1500 pf 5% 25V N150 Polystyrene
C-69	23C62914A06	25 mf 15V lytic (USE 23C543075)
C-70	21S135299	.01 mf +80-20% 100V (USE 21S135297)
C-71	8S10226A10	1300 pf 5% 33V N150 polystyrene
C-72	8S10226A07	10000 pf 5% 63V N150 polystyrene
C-73	21C62258A02	220 pf 10% 500V (USE 21R132503)
C-74	21D62461A07	.5 mf 10% 10V
C-75	8S10226A09	820 pf 5% 33V N150 polystyrene
C-76	21C62258A02	220 pf 10% 500V (USE 21R132503)
C-77	21C62258A02	220 pf 10% 500V (USE 21R132503)
C-78	21C62258A02	220 pf 10% 500V (USE 21R132503)
C-79	21C62258A02	220 pf 10% 500V (USE 21R132503)
C-80	21C62258A02	220 pf 10% 500V (USE 21R132503)
C-81	21S135658	.01 mf +80-20% Z5U 100V
C-82	21S135658	.01 mf +80-20% Z5U 100V
C-83	8S10221A02	.047 mf 20% 250V polyester
C-84	21S135296	.05 mf +80-20% 25V
C-85	21S135296	.05 mf +80-20% 25V
C-86	8S10226A03	1500 pf 5% 25V N150 polystyrene
C-87	21S135296	.05 mf +80-20% 25V
C-94	21S128634	.005 mf 10% 500V
C-95	21S135311	470 pf 10% 100V
C-100	*23K648082	150 mf-150V; 80 mf-25V; 250 mf-25V lytic
C-101	8S131900	.05 mf 20% 400V mylar (USE 8R128690)
C-102	23K647828	100 mf 15V lytic (USE 23D543074)
C-103	21D62461A04	.5 mf +80-20% 10V
C-104	21D62461A04	.5 mf +80-20% 10V
C-105	23C62914A02	5 mf 15V lytic
C-106	23C62914A02	5 mf 15V lytic
C-107	23C62914A02	5 mf 15V lytic
C-108	21S135295	.1 mf 20% 25V
C-109	23C62914A02	5 mf 15V lytic
C-110	21S135295	.1 mf 20% 25V
C-111	23C62914A02	5 mf 15V lytic
C-112	21S135295	.1 mf 20% 25V
C-113	21S135295	.1 mf 20% 25V
C-114	21S135300	.0033 mf 10% 500V
C-115	21S135300	.0033 mf 10% 500V
C-116	*23C62914A13	500 mf -10+150% 6V lytic
C-117	21S135295	.1 mf 20% 25V
C-118	21S135295	.1 mf 20% 25V
C-119	23C43280A22	1 mf +100-20% 10V lytic
C-120	23K647828	100 mf 15V lytic (USE 23D543074)
MISCELLANEOUS ELECTRICAL PARTS		
E-2	48D63590A01	DIODE, crystal
E-3	48D63590A01	DIODE, crystal
E-5	48K644681	DIODE, crystal (USE 48R134587)
E-6	48K644681	DIODE, crystal (USE 48R134587)
E-7	48K644681	DIODE, crystal (USE 48R134587)
E-8	48B62334A01	DIODE, crystal (USE 48B62334A02)
E-9	48B62334A01	DIODE, crystal (USE 48B62334A02)
E-10	48B62334A01	DIODE, crystal (USE 48B62334A02)
E-11	48B62334A01	DIODE, crystal (USE 48B62334A02)
E-12	48B62334A01	DIODE, crystal (USE 48B62334A02)
E-13	48B62334A01	DIODE, crystal (USE 48B62334A02)
E-14	65S134388	BULB, stereo: 10V-100EFC
E-15	*65S135615	BULB, dial: AM-FM: 24V-200EFC
E-16	65S135615	BULB, dial: AM-FM: 24V-200EFC
E-17	48K644681	DIODE, crystal: (USE 48R134587)
E-18	48S10062A05	RECTIFIER, silicon
E-19	51K754068	RES-CAP (USE 51C67517A01)
E-20	51K754068	RES-CAP (USE 51C67517A01)
COILS		
L-1	24B61746A04	ANTENNA, ferrite core
L-2	24C63348A02	OSCILLATOR
L-7	24C63196A01	AM-RF
L-8	24K648129	ANTENNA PEAKING COIL
L-9	24C61620A03	CHOKE, filter
CONTROLS & RESISTORS		
R-75	18B63499A01	CONTROL, gain
R-90	17K751479	4.7K 10% 3W
R-100	*17S135732	120 10% 5W
R-104		3.9K 10% 2W
R-106	*18D63155A02	CONTROL, on-off & loudness
R-127	*18D63155A03	CONTROL, tone
R-128	*18D63155A01	CONTROL, balance
SWITCH		
S-1, S-2	*40C60279B01	SWITCH, rotary: AM-FM-STEREO
TRANSFORMERS		
T-2	24C63304A01	IF: 10.7MC
T-3	24C63304A01	IF: 10.7MC
T-4	24D63346A03	IF: 455KC
T-5	24C63304A01	IF: 10.7MC
T-6	24D63346A02	IF: 455KC
T-7	24C63345A01	RATIO DETECTOR
T-8	24C63463A02	MX
T-9	*25D63503A06	OUTPUT
T-10	25D63503A06	OUTPUT
T-11	24C63463A01	MX
T-12	24C63463A01	MX
T-13	24C63463A01	MX
TRANSISTORS		
Q-4	48S134826	M4826
Q-5	48S134826	M4826
Q-6	48S134826	M4826
Q-8	48S134906	A1J
Q-9	48S134906	A1J
Q-10	48S134768	M4768
Q-11	48S134732	M4732
Q-12	48S134732	M4732
Q-13	48S134732	M4732
Q-14	48S134732	M4732
Q-15	48S134872	M4872
Q-16	48S134872	M4872

Parts List Cont'd On Page 13



NOTES:
CAPACITORS-UNLESS OTHERWISE SPECIFIED,
DECIMAL VALUES IN MF; ALL OTHERS IN PF
VOLTAGES-MEASURED FROM POINT INDICATED
TO B- WITH A VTVM ± 10% NO SIGNAL INPUT.

TUNING RANGE-AM - 535 KC TO 1620 KC. IF - 455 KC
FM - 88 MC TO 108 MC. IF - 10.7 MC

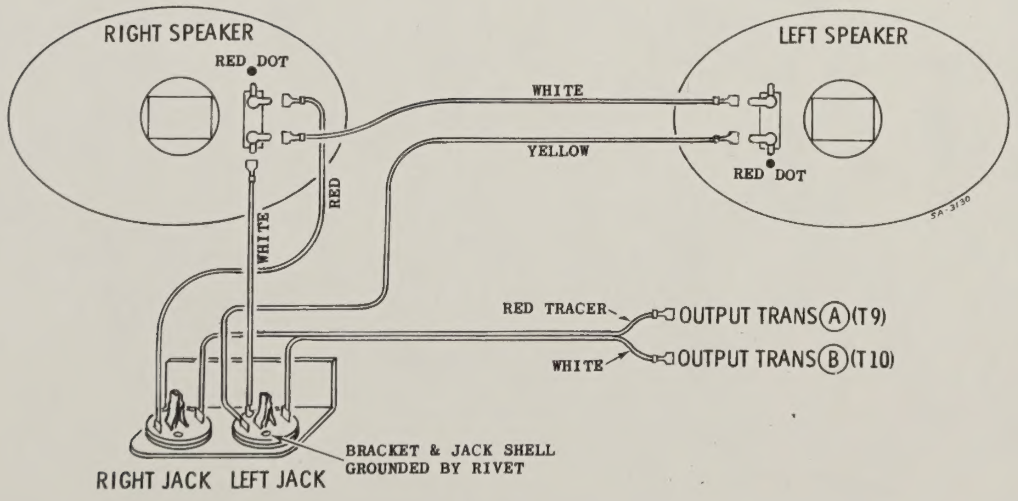
LINE CORD CAPACITY COUPLED
TO A FOR INT ANT CONN

FOR EXT ANT, REMOVE COUPLER FROM A
& CONNECT 300Ω EXT ANT TO A & B

WHERE TWO VOLTAGES ARE SHOWN,
UPPER VOLTAGE IS IN FM POSITION.
LOWER VOLTAGE IN AM POSITION.

Q1 M4825 FM RF AMP
Q2 M4826 FM OSC
Q3 M4837 FM MIXER
Q4 M4826 1ST FM IF AMP, AM RF
Q5 M4826 2ND FM IF AM CONV
Q6 M4826 3RD FM IF 1ST AM IF
Q7 M4826 4TH FM IF
T7 FM DET
MULTIPLEX BOARD
Q8 M4906 19KC AMP
Q9 M4906 38KC DOUBLER
Q10 M4768 STEREO IND AMP
E14 STEREO IND LIGHT
R75 820 19KC GAIN
Q11 M4732 AUDIO PRE-AMP
Q12 M4732 AUDIO PRE-AMP
Q13 M4732 DRIVER
Q14 M4732 DRIVER
Q15 M4872 PWR-AMP
Q16 M4872 PWR-AMP
RT CHANNEL
LEFT CHANNEL
RIGHT CHANNEL
LOUDNESS
TONE
BALANCE
T9
T10
AGC
AFC
AM
B+
B++
AM ANT
ON-OFF SW (ON VOL CONT)
(ON BAL CONT)
FM STEREO REAR VIEW
AM LIGHT
FM LIGHT
L2 & L7 BOT VIEW
T2, T3, T4, T5, T6, T8 & T12 BOT VIEW
T1 BOT VIEW
SILICON
Q1 THRU Q10
BOT VIEW M4872
BOT VIEW M4825, M4826, M4732, M4837, M4906
SELECTOR SW
REAR
INDEX TAB
AM POS
FM POS
REAR VIEW
DIAG. 63E63009A48-0

SCHEMATIC DIAGRAM



RIGHT SPEAKER
LEFT SPEAKER
RED DOT
WHITE
YELLOW
RED
RED TRACER
OUTPUT TRANS(A)(T9)
OUTPUT TRANS(B)(T10)
BRACKET & JACK SHELL GROUNDED BY RIVET
RIGHT JACK
LEFT JACK

SPEAKER WIRING DETAIL

SERVICE EXPERIENCES - COLOR TV CHASSIS

The following is an up-dated list of the most common service experiences with the various Motorola color chassis. This includes the former TS-908 and the later ETS-908, the TS-914 and the newer TS-A914 chassis. This list was compiled from reports of our distributor service managers, our regional service managers and especially the Field Required Service Reports that have been sent in from our distributor service managers.

SYMPTOM	SOLUTION
TS-914 CHASSIS - EARLY VERSIONS	
Low brightness.	A. Check value of R-224 connected from arm to ground of master G-1 control. If the value of this resistor is 47K ohms, change it to 150K ohms and re-adjust background and master G-1 control. B. Low brightness can also be caused by low emission of the 1st video amplifier tube V-6 (6DX8) and/or the 2nd video amplifier tube V-7 (6LY8). The conduction of these tubes affects the plate voltage of the video output tube and thus the voltage of the cathodes of the CRT. C. Also, check the value of the contrast control. It should be 200 ohms. Higher resistance will also reduce brightness.
No high voltage. Horizontal oscillator inoperative.	Often caused by a shorted 6EJ7, 3rd video IF tube. The screen voltage for both the horizontal oscillator and the 3rd IF tube is supplied from the same B+ 160 volt source, thus a shorted 3rd IF tube will also kill the screen voltage to the horizontal oscillator tube. (This circuit has been modified in the current A-914 chassis.)
Vertical size shrinkage.	Sometimes caused by the 6JS6 horizontal output tube. The beam forming plates of this tube are connected into the cathode circuit of the vertical output tube. Some of these 6JS6 tubes used uncoated beam forming plates and developed secondary emmission which affected the bias of the vertical output tube. The remedy is to use a Motorola branded 6JS6 horizontal output tube with coated or blackened beam forming plates.
Vertical compression at or near top of raster.	This condition existed on some early run TS-914 chassis. The linearity can be improved by making the following changes in the vertical oscillator feed-back network. Replace C-606 - .039 mfd with a .033 mfd, 10% capacitor. Replace C-610 - .033 mfd with a .039 mfd, 10% capacitor. Replace R-614 - 47K ohm with a 39K ohm, 5% resistor.
Excessive width.	Some earlier TS-914 sets tended to have horizontal overscan, especially when operated on high line voltage. There was no width control on these sets. Width can be controlled by installing part number 24P65142A75 per instructions included with the new coil.
Open CRT filaments.	When replacing the CRT in TS-914 chassis, be sure to remove the two filament by-pass capacitors C-803 and C-805, .001 mfd. (As a matter of practice, when working on a TS-914 chassis for any reason, the two capacitors should be clipped out.)
High frequency interference pattern, usually on lower right portion of screen only. Sometimes bands of thin horizontal black lines on the screen.	This is usually caused by oscillation of the pincushion transistor. Add two 33 mmfd disc capacitors one from base to emitter and base to collector of the transistor or replace transistor. (If the pincushion corrector unit is suspected of causing any form of interference on the screen, it may be temporarily disconnected from the yoke and a jumper wire used from the gray to black terminals of the yoke to complete the vertical yoke circuit.)

SYMPTOM	SOLUTION
Light gray vertical bars in background on black and white (appears similar to color bar pattern with no color).	3.58 crystal in color oscillator producing harmonics. Replace the crystal.
No color or intermittent distorted color.	Leakage or short between primary and secondary of T-900, 2nd color IF transformer. (Additional insulation was added between the windings of this transformer on later and current run sets.)

TS-914 AND TS-A914 CHASSIS

The following problem symptoms may be found in either the former TS-914 or the current TS-A914 chassis.

Retrace lines at top of screen. Varies with picture content. Reduced vertical sync.	Open IF AGC by-pass capacitor C-400, .25 mfd. This problem is sometimes difficult to pin down due to the fact that the picture seems almost normal except for the retrace lines and these disappear at low brightness and at normal brightness on some pictures. There is also a .002 mfd by-pass in this circuit which partially by-passes the AGC even if the .25 mfd is open. A good indication of the open .25 by-pass capacitor is to roll the picture down to observe the vertical blanking bar. At normal brightness and contrast settings, this bar will be gray rather than black.
Low brightness.	A. Defective V-7A - 6LY8 video output tube. (Low emission.) B. Defective V-6A - 6DX8 - 1st video tube. (Low emission.) C. Open L-108 peaking coil. D. Open L-109 delay line.
Excessive brightness, no control.	Shorted or gassy 2nd video amplifier tube.
Set overloads, picture twists and pulls. Can't adjust noise gate. Can't adjust high voltage with horizontal bias control. Bias at grid of 6JS6 horizontal output tube low. Snivets in UHF.	A. Shorted E-502 regulator diode. B. Shorted C-700, .1 mfd capacitor in pincushion corrector circuit. (It is possible that some receivers may produce a useable picture with the diode shorted but such sets will likely have a high failure rate of the 6JS6 horizontal output tube. If a receiver does have excessive failure rate of these tubes, the above should be checked.)
Picture stretched on top, compressed on bottom. Badly out of convergence. Vertical hold control out of range or at end of range.	Shorted C-611, 50 mfd lytic. Cathode circuit of vertical output tube. (On top of chassis.)
Picture stretched at top, compressed at bottom. Not enough vertical size. Hold control out of range.	Open C-611, 50 mfd lytic in cathode of vertical output tube (on top of chassis).
Set out of convergence. Adjustment of red-green or blue vertical amplitude controls have no effect.	Negative can of C-611, 50 mfd lytic shorting to chassis. (The supporting metal clips for this capacitor sometimes cuts through the insulating jacket of the capacitor.)
No color.	Coax lead from center arm of color intensity control shorted between center conductor and ground lead of coax.
Purity hard to set or purity will not stay in adjustment.	Check to see if the four ears on the front yoke clamp are firmly stuck to the CRT bell. If this clamp is loose from the tube bell, the yoke will likely misalign horizontally with the tube neck thus making it difficult to set purity and the yoke position may shift with use.

SYMPTOM	SOLUTION
Set out of color sync or falls out of color sync erratically.	Likely cause is misadjustment of color oscillator transformer L-904. Turn color killer all the way clockwise; use weak color signal and adjust transformer for best color sync. Re-adjust color killer. (This adjustment can be made from the top of the chassis.)
No color. Screen turns green.	Indicates the color oscillator is inoperative. Normally caused by defective crystal, defective T-902 sync filter transformer, 6LE8 modulator tube or associated components.
Low color gain. Intermittent color. Indicator light turns off at high color gain settings.	Peaking coil L-900 in cathode of first color IF open.
No sound (except squeal) or intermittent sound.	Check for open solder joint at ground lead of quadrature coil (at chassis).
No picture. Raster okay.	Open R-115, 200 ohm potentiometer in secondary circuit of T-102, 3rd IF transformer. Short across the potentiometer with screw driver to check.
Color killer critical to set. Has to frequently be re-set.	Leaky C-922, .05 mfd, 100 volt disc capacitor from grid of killer tube to ground. Replace.
Picture overloads or blanks out when changing channels. AGC control action not normal.	Change 3rd IF tube.
Vertical line left of center of screen. Left side of raster may be lighter than rest of screen.	If the line moves in a direction opposite to the picture when the hold control is turned, the problem is due to lack of horizontal retrace blanking. Check C-202, R-204 and E-200 blanking diode.
Critical color killer adjustment. Intermittent loss of color. (If killer is adjusted to positively kill on black and white signals, set may not make dependable color.)	In the TS-914 and TS-A914 chassis, the problem is most frequently due to insufficient switching voltage to allow the killer circuit to function properly. Normally, the bias on the grid of the color killer tube is set up on black and white transmissions to permit the killer tube to conduct and produce sufficient negative bias at the control grid of the 2nd color IF amplifier tube V-16B to cut the tube off, thus preventing any high frequency noise or black and white signal components from reaching the demodulator stage. Then, when a color signal is received, it is absolutely necessary that an additional negative voltage be supplied to the grid of the killer tube to drive this tube out of conduction and thus remove the bias from the 2nd color IF tube so that it can amplify normally. This additional negative voltage to the killer tube is known as the switching voltage. The switching voltage in the 914 chassis is obtained from the oscillator grid of the 6LE8 color oscillator-demodulator tube. On a normally operating set, voltage between the grid and cathode of the color oscillator tube will be approximately minus 3 volts at the grid while the set is operating on a black and white transmission. This voltage is coupled back to the grid of the killer tube through resistor R-925, 470K ohms. When the receiver is tuned to a color transmission, the color sync signal rings the color oscillator crystal and the color oscillator tube oscillates much harder. This causes the negative voltage at the oscillator grid to go to approximately 4 volts negative compared to the cathode. This additional one volt negative is thus fed back to the color killer grid and starts to drive the killer tube out of conduction. This reduced killer conduction allows the 2nd color IF tube to begin drawing plate current. Examination of the schematic diagram will reveal that the plate circuit of this 2nd color IF tube is fed through a 10K voltage dropping resistor,

SYMPTOM	SOLUTION

R-910. Therefore, the voltage at the load side of this resistor drops down from 385 volts to approximately 285 volts when the 2nd IF tube begins to draw plate current. The load side of this dropping resistor is connected into the grid circuit of the killer tube through resistors R-909 and R-925. Thus, when the 2nd color IF does begin to conduct, this reduced positive feedback to the grid of the color killer results in a flywheel effect and permits the total voltage between the grid and cathode of the killer to rise sufficiently to completely cut off the killer tube.

It can be seen if the color oscillator-demodulator portion of the receiver is not operating normally, it can result in insufficient switching voltage to allow the killer tube to operate in its normal manner. The most common cause of abnormal operation of the color oscillator-demodulator circuit is misalignment of the oscillator screen trap, L-907, oscillator coil, L-904 and the sync filter transformer T-902 or a defective 6LE8 demodulator tube.

A good method of determining whether or not erratic color operation is due to insufficient switching voltage is to proceed as follows:

1. Connect a VTVM between the cathode and grid of the color killer tube V-7B. Be sure to connect the ground lead of the meter to the cathode of the tube and the hot lead to the grid. A good place to reach the cathode is at test point "A" at the low side of the color oscillator coil as shown in the schematic.

2. After connecting the meter as indicated above, carefully set the color killer control until the color indicator light just goes out on a black and white signal.

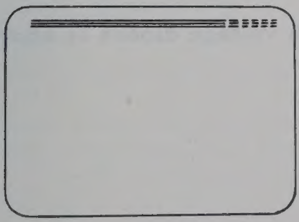
3. Carefully set the horizontal hold control to the center of the horizontal lock in range. This is very important as the setting of the control can affect the color killer action.

4. Make a note of the voltage reading obtained which should be somewhere around 1 to 1.5 volts negative while the set is tuned to a black and white signal.

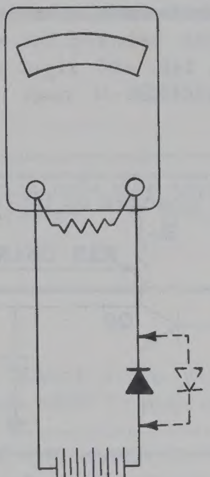
5. Now tune the receiver to a medium to weak strength color signal with proper fine tuning and hue control setting. The voltage reading should now be two volts higher than the former reading. A reading of appreciably less than two volts increase will probably be the cause of the undependable color operation of the receiver. In other words, it is absolutely necessary that the additional negative bias on the killer grid be sufficient to completely cut this tube off and remove the bias from the grid of the 2nd color IF tube.

First, lets assume that the set did pass the test and did make 2 or more volts additional bias at the killer grid on a color signal. This would normally indicate that the color demodulator-oscillator portion of the receiver, which produces the switching voltage is okay. It would now be logical to assume that the real fault would lie somewhere in the color killer or color IF circuits themselves. Likely faults would be:

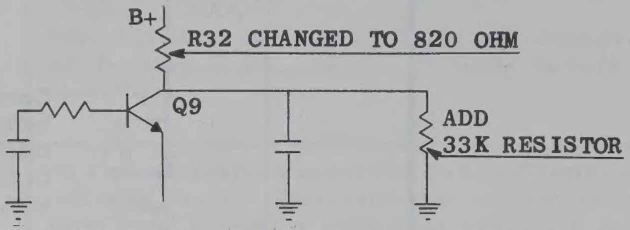
The color killer tube, 6LY8. (The grid of this tube looks into a very high impedance circuit. Therefore, any leakage or change of conduction in this tube would cause a change in grid bias.) Also, any leakage of C-922, .05 mfd, 100 volt capacitor going from grid to ground would upset the color killer action. Also, the resistors and color killer control in the grid circuit of the killer tube should be suspected. A good method to spot any intermittent operation of these components is to leave the meter connected between the grid and cathodes of the killer tube, tune the set to a steady color bar pattern and monitor the voltage to see if there is any variation over a period of time.

SYMPTOM	SOLUTION
	Also, the color IF stage itself might be the cause of the intermittent operation. The 6DX8 color IF tube should be changed and the associated components checked out. Shorting of shielded cables going from the arm of the color intensity control; the inner conductor of this lead sometimes shorts to the outer shield. Now, let's assume that the set did not pass the test and did not make 2 volts or more additional voltage at the grid of the killer tube when we tuned the set to a color signal. A switching voltage of around 1.5 volts would be very marginal and would very likely be the cause of the erratic operation of the set. Low switching voltage is usually caused by misalignment of the demodulator screen trap L-907, color oscillator coil, L-904 and sync filter transformer T-902. If these transformers are out of adjustment, the voltage at the color oscillator grid will not change sufficiently between black and white and color signals to furnish sufficient switching voltage to the killer grid. Complete instructions for alignment of this circuit is given in the 914 service manual. This procedure is not at all difficult to follow but instructions should be followed exactly. It is very important that the meter used be a VTVMtype only and the 5.6 meg isolating resistor be used as specified. A new 6LE8 color oscillator-demodulator tube should be tried before performing the circuit alignment as the tube itself could be the cause of the low switching voltage.
TS-A914 CHASSIS ONLY The only problem symptoms in the TS-A914 chassis that might not also be found in the former TS-914 chassis pertain to the automatic degaussing circuit. They are:	
B+ short. Trips circuit breaker.	On the early automatic degaussing switches, a short could develop between a portion of the heater coil and one of the heater coil leads. This heater coil is wound around the bi-metal switch arm. When this happened, the six volts was applied across only a portion of the coil and this portion got excessively hot. This caused the bi-metal arm to bend upwards and short to the grounded case. The leads on the later switches have an insulating sleeve to prevent this condition from occuring.
Small size picture. Color bands in picture. Out of focus. B++ about 100 volts too low.	Open degaussing switch. Caused by open heater coil or defective switch contacts. (On later production sets, a 220 ohm, 2 watt resistor is wired into the circuit across the switch contacts to prevent arcing of the contacts. Replacement switches have the resistor included and if a set is found that does not already have the resistor, it should be added.
Part of vertical sync bar shows in top area of picture. 	Part of the vertical blanking bar is visible in the top area of the raster due to excessive retrace time in the vertical output of the receiver. This condition is more pronounced on some color shows as a white reference line and a series of white dots are transmitted in the sync. As the vertical hold control is rotated to tend to cause the picture to roll downward, the lines will move toward the top of the raster and when the hold control is rotated to tend to cause the picture to roll upwards, the lines will go further down into the picture. This problem is due to excessive loading of the vertical output circuits in the receiver which causes excessively long vertical retrace time. The problem may or may not also cause vertical non-linearity or compression at the top of the raster, depending on how severe the loading is. The problem is frequently caused by trouble in the vertical portion of

SYMPTOM	SOLUTION
	the convergence panel and in some instances is due to a defective vertical output transformer. The simpliest method to isolate this problem would be to disconnect the vertical convergence windings from the convergence panel to see if the problem disappears. If it does, the trouble is definitely in the convergence panel itself. Likely troubles in the panel would be shorted or wrong values of the R-G vertical tilt, blue vertical tilt or the R-G vertical differential tilt potentiometers or other associated wiring or components in the vertical portion of the panel. If the problem does not prove to be in the convergence panel, the most likely cause would be the vertical output tube or the vertical output transformer itself which may have shorted turns in the convergence windings or shorts to ground.
ETS-908 CHASSIS	
Retrace lines at top of picture. Poor vertical sync. Hook in top of picture. (Sometimes intermittent.)	This condition is caused by open IF AGC by-pass capacitor C-402 or RF by-pass C-401. If the condition is hard to pin down, replace both capacitors.
High pitched audio note in speaker only on color signals.	On some chassis, a capacitor C-910 .01 mfd was wired across the color indicator lamp. This capacitor and the lamp series resistor and the neon lamp formed a relaxation oscillator and produced the 800 cycle signal when the lamp was burning. This signal was coupled into the audio by the long lamp leads from the tuner panel to the chassis. Clip out the capacitor.
Poor vertical sync - certain channels only. (No overload. AGC and noise gate set properly.)	The sync from some transmitters and on cable systems often has spikes and transients. These tend to pre-trigger the vertical oscillator through the sync clipper. This problem can be solved by connecting a small disc capacitor around 30 mmfd from the grid of the clipper tube V-11B to ground. Use smallest value of capacitor that will solve the problem.
Low brightness.	Check resistance of contrast control. Should be 200 ohms. If it has increased in value, replace it.
Excessive blooming of picture at high contrast settings.	Change R-147, 18 ohm resistor in cathode of video output tube to 47 ohms.
Inadequate AGC range or intermittent AGC action. Pull and twist.	Several instances of intermittent noise gate controls R-402 have been reported.
Remote control very insensitive.	Check for cold solder joint in cable at mike plug.
Testing boosted boot diode, E-501 (All 908 chassis.)	This diode cannot be tested with an ordinary ohmmeter as it consists of a number of diodes in series. The internal voltage in the ohmmeter is not sufficient to forward bias the diode sufficiently to cause it to conduct current in either direction, thus it reads open. A good method of testing this and other high voltage diodes is shown.

SYMPTOM	SOLUTION
	A 45 volt battery is used and the meter set to the 50 volt scale. The one meg load resistor is needed to load the diode and prevent a high resistance diode from testing good.  Use VTVM set for 50 volt DC scale. Compare readings with diode connected both ways. Readings should be almost full battery voltage with diode connected in forward direction and almost zero with the diode connected in reverse.

SERVICE EXPERIENCES - STEREO

<table>
<tr><th>SYMPTOM</th><th>SOLUTION</th></tr>
<tr><td>Excessive high frequency response - All models using solid state horns.</td><td>Some 1966 models may exhibit noisy reception due to the high efficiency of the Solid State Horns. To attenuate this noise, place a 150 ohm, 5 watt wire wound resistor in series with hot lead of each high frequency horn. The resistor, with lugs is available from Parts Order Department under Part No. 1V63051A42. This resistor is currently being installed in production.</td></tr>
<tr><td>SK-550 thru SD-657 "In Lid Models" Audio rectification: AM-FM Phono (FM, AM, short wave, amateur, police radio, etc.) heard at zero volume setting with selector switch in any position.</td><td>This can occur due to close proximity of a radio or television station. This can be minimized or eliminated by placing a 820 mmf disc ceramic capacitor between the emitter and base of the first audio pre-amplifier stages, left and right channels. This capacitor is now being installed in production.</td></tr>
<tr><td>SK-550 thru SK-554 Motor boating when changer cycles (early production).</td><td>Circuit changed on HS-2338B version as shown:

 </td></tr>
<tr><td>PP-200 - Stylus skipping grooves on record.</td><td>May be caused by cartridge. Replace with new improved version (better compliance), Part Number 59P63028A32.</td></tr>
<tr><td>PP-302 (HS-2336) - Hiss or noise on one channel.</td><td>R-8 or R-27, 15K resistor may be the cause. This resistor is located in the collector circuit of Q-1 or Q-2. (This could also be caused by one of these transistors.)</td></tr>
<tr><td>Electrolytic capacitors for HS-2334, 2338, 2349, 2350, HS-1245 and HS-1264.</td><td>These chassis used electrolytics in a cardboard cylinder. To improve reliability, the following capacitors are being used for replacements.
<table>
<tr><th>CHASSIS</th><th>ORIGINAL LYTIC</th><th>IMPROVED LYTIC</th></tr>
<tr><td>HS-2334</td><td>23C63500A01</td><td>23D63176A03</td></tr>
<tr><td>HS-2338</td><td>23C61012A05</td><td>23D63176A02</td></tr>
<tr><td>HS-2349</td><td>23C63500A01</td><td>23D63176A03</td></tr>
<tr><td>HS-2350</td><td>23C63540A02</td><td>23D63176A04</td></tr>
<tr><td>HS-1245</td><td>23C61012A03</td><td>23D63176A02</td></tr>
<tr><td>HS-1264</td><td>23C61012A03</td><td>23D63176A02</td></tr>
</table>
When replacing the above lytics, cut the leads at the case of the lytic since the replacement does not have leads.</td></tr>
</table>

It has been brought to our attention that many service men are not aware that we use a solid state cartridge in some of our stereos for 1966. As you know, this cartridge requires a DC voltage for operation.

This voltage is derived from the electronic filter transistor Q-9 which is located on the power amplifier chassis.

If it is suspected that the cartridge is bad and replacement does not restore normal operation, check for presence of DC voltage at cartridge.

HS-2339 - Low AM Sensitivity (In-well tuners).	There have been many cases reported of weak AM reception on early production of these tuners. Refer to Bulletin #12-DSB-HS-65 which gives instructions for modifications of these tuners and alignment information. These minor revisions and re-alignment of the mixer-oscillator stages solves the problem.
HS-2331 - AM sound weak and distorted.	If these symptoms are present and tuning meter does not operate, check for open meter.

SERVICE EXPERIENCES - BLACK AND WHITE TELEVISION

SYMPTOM	SOLUTION
TS-597 CHASSIS	
Picture blanks out on strong signal (raster okay).	Check for open R-803, 3.3K ohm, 7 watt resistor mounted on C-810 lytic.
AGC overload.	A high failure rate was experienced with the noise gate transistor Q-100 in this receiver. It should be replaced with part number 48S134853 transistor.
TS-589"C" CHASSIS	
Low brightness.	Check for short from pin #3 of CRT socket to ground. Lowers boot voltage from 450V to approximately 250V.
Snow on all channels. Off channel noise looks like high voltage arc.	Defective E-201 horizontal blanking diode.
TS-454 CHASSIS	
Intermittent raster.	Check R-513, 820 ohm in screen circuit of horizontal output tube. Resistor sometimes opens up or increases in value.
Small vertical size.	Check resistor R-619, 1.8 meg in vertical size control circuit for increase in resistance or open.
White vertical line left of center of screen. (Moves when horizontal hold control is adjusted.)	Check C-201, .01 mfd, 2KV in screen circuit of CRT.
TS-588 AND TS-589 CHASSIS	
Series of vertical gray bars across screen.	Check E-201 blanking diode for short (screen circuit of CRT).
No vertical sync (horizontal sync okay).	Check E-601 diode for short (in cathode of vertical oscillator).
Intermittent operation of horizontal oscillator.	Check phase detector diodes E-501 and E-502. If they show dissimilar readings, replace both diodes.

SERVICE EXPERIENCES - CAR RADIO

The following car radio problem symptoms have been reported recurrently.

SYMPTOM	SOLUTION
Models CT66A, Etc. - Stations on high end of band drift and fade.	Replace C-9, a .01 mfd converter by-pass capacitor.
Models CT66A, Etc. - Completely dead or fluctuating audio.	Replace Q-4, 1st audio transistor.
Models CT66A, Etc - Distortion on strong RF signals.	Replace AVC diode, E-1.
Excessive motor noise - all models.	Refer to modifications described in bulletin 7-DSB-CS-66.
10 ohm radios with FMC62 and FM65M - Inability to peak AM antenna trimmer for maximum sensitivity.	Add a 220 pfd capacitor in series with antenna cable between AM radio and FM converter. This capacitor is available as an assembly containing convenient connectors, part number 1P64978A05. (See Bulletin 3-DSB-CS-65.)
Chrysler Radio 365S - Intermittent or dead.	Replace RF and oscillator trimmer assembly, part no. 20C40481A09.
R200 - Distortion in radios using 10 ohm speakers.	Install cable kit, Part Number 1K64978A32.
FMC62 - FM converter quits when battery voltage drops.	Check 6GM8 RF amplifier and 12AD6, 1400Kc oscillator tubes by substitution; also check Zener diode, E-2, Motorola Part No. 48R10051A01.

MOORE EQUIPMENT, INC.
13 BRUEN ST.
DAYTON 2, OHIO

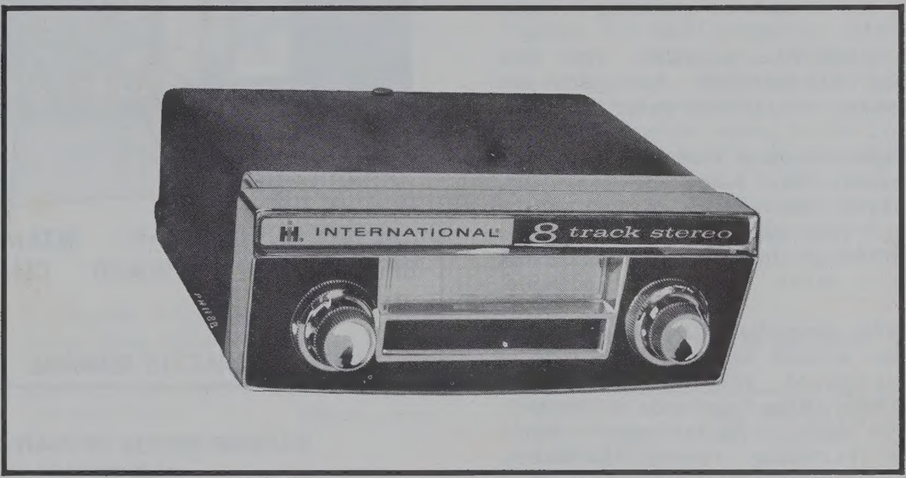
automotive stereo 8 track tape player MANUAL 68P43101A19

MOTOROLA P6MH

INTERNATIONAL HARVESTER 244708-R91

MOTOROLA service manual

GENERAL INFORMATION



This model is designed for installation in the following International Harvester vehicles: 1000A-1500A, CO-4000, Fleetstar, Loadstar, Metro, R & V line, Scout.

WARRANTY SERVICE STATION PROCEDURE

1. A defective in-guarantee player must be accompanied by the Customer's Guarantee Policy Tag. This tag must be properly filled in by the International Harvester dealer at the time of the player purchase. Accept as guarantee repairs only those players within the 12 months or 24,000 miles (whichever occurs first) guarantee period. The removal or re-installation of this player is customarily performed by the International Harvester dealer and is not covered by this guarantee. Also, the removal of motor noise, tire static, electrical interference and faulty installations are not considered as guarantee repairs and, therefore, expenses related to such services should be handled by the dealer.

2. Fill in Motorola Guarantee Labor Claim, Part Number 68P60016A30, and mail Green and Pink copies to:

Motorola Guarantee Service
Motorola, Inc.
9401 West Grand Avenue
Franklin Park, Illinois.

3. The yellow copy of the Motorola Guarantee Labor Claim is to be retained by the authorized service station for his files.

4. Defective parts for guarantee repairs made on this model are to be sent to your Motorola Distributor for free replacement supported with the defective parts return tag or form which you are now using.

5. Only those service shops authorized by their Motorola Distributor can perform guarantee repairs on a no-charge basis to the customer. If you are not already authorized as a Motorola Auto Radio Service Station and you are interested in handling this service, please contact your Motorola Distributor for complete details.

OPERATING INSTRUCTIONS

OPERATION

TO PLAY TAPES - Turn unit on by inserting a tape cartridge (label side up and open end first) into the tape slot. Push the cartridge in until it is firmly seated. (THIS IS IMPORTANT.) The tape cartridge will now play, in succession, all four channels. Adjust volume, tone and balance as required.

CAUTION: The tape cartridge should always be pulled out completely or approximately 1" from the seated (play) position before leaving car.

TAPE CARTRIDGE CARE

To assure maximum life and noise free operation, tapes should be stored in a cool, clean and dry place, out of the rays of the sun and with the open (tape) end down.

SERVICE NOTES

GENERAL SERVICE NOTES

1. POLARITY - WHEN SERVICING THIS UNIT, THE "A" LEAD MUST BE CONNECTED TO THE POSITIVE SIDE OF POWER SOURCE. IF CONNECTED OTHERWISE, UNIT WILL NOT OPERATE AND DAMAGE TO COMPONENTS MAY RESULT.

2. POWER SUPPLY REQUIREMENTS - It is preferable to use a storage battery (without a battery charger) in place of a battery eliminator. If a battery eliminator is used, it must be well filtered and regulated.

3. OUTPUT LOAD - Always operate this unit with an output load across each of the two channels; either 8 ohm speakers or 8 ohm, 5 watt resistive loads can be used.

4. TRANSISTOR REPLACEMENT - When replacing a transistor other than a power or regulator transistor, grasp the transistor leads between transistor body and plated chassis board with a pair of long nose pliers to prevent excessive heating of transistor body during soldering operation.

MOTOROLA INC. 9401 WEST GRAND AVENUE, FRANKLIN PARK, ILLINOIS

PART NO. 68P43101A19 3-67 PRICE 35 CENTS

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5. POWER AND REGULATOR TRANSISTOR REPLACEMENT - When replacing a power or regulator transistor, be sure to:

A. Use the transistor specified in the Replacement Parts List.

B. Coat both sides of transistor insulator with DC-4 grease (Motorola Part No. 11M490487) to insure proper heat dissipation.

C. Securely and evenly tighten the transistor mounting screws.

6. GAINING ACCESS TO THE PLATED BOARDS - Remove top and bottom covers and refer to photo.

Tape Pre-Amp Plated Board - To remove this board for servicing, merely unsolder the chassis ground lead (see photo), bend the copper retaining clip and lift up the chassis to a more serviceable position.

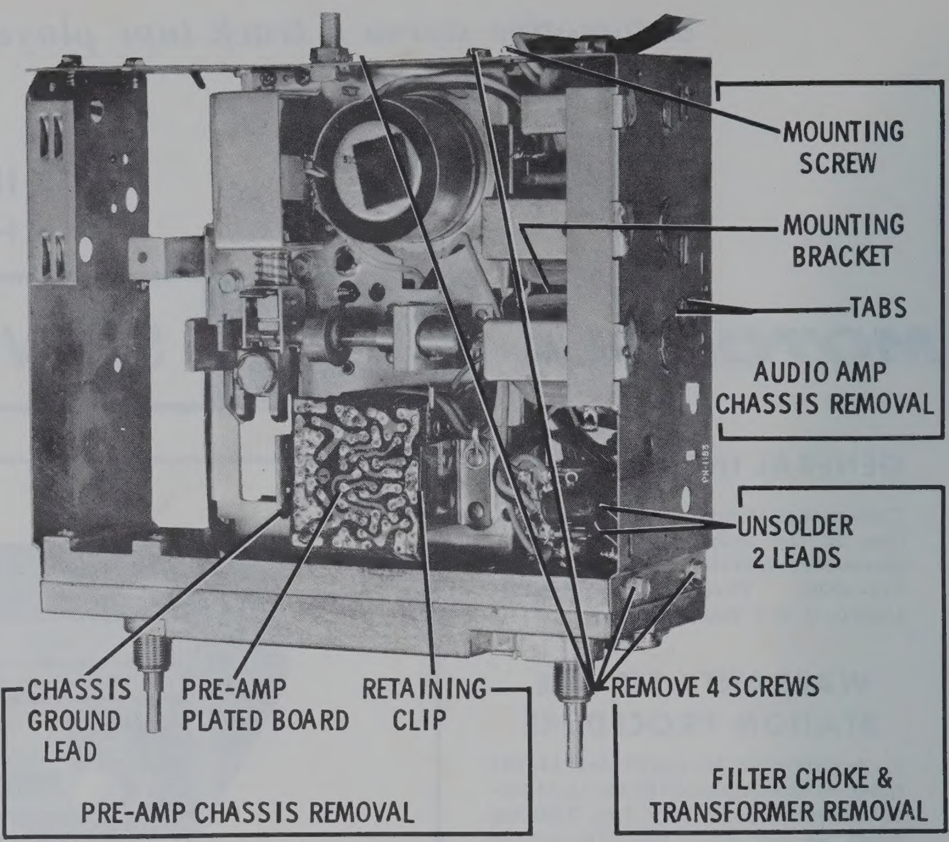
Audio Amplifier Plated Board - To gain access to the bottom side of this board, remove the two (2) screws at the front side of the radio (see photo). To remove the board for servicing, remove the screw from the mounting bracket, unsolder the tabs, straighten the tabs, then remove the mounting bracket.

7. OUTPUT TRANSFORMER AND FILTER CHOKE REPLACEMENT - Remove 4 screws, 2 at front side and 2 at rear (see photo); also unsolder control ground leads from wraparound and pull out wraparound far enough to remove transformer or filter choke.

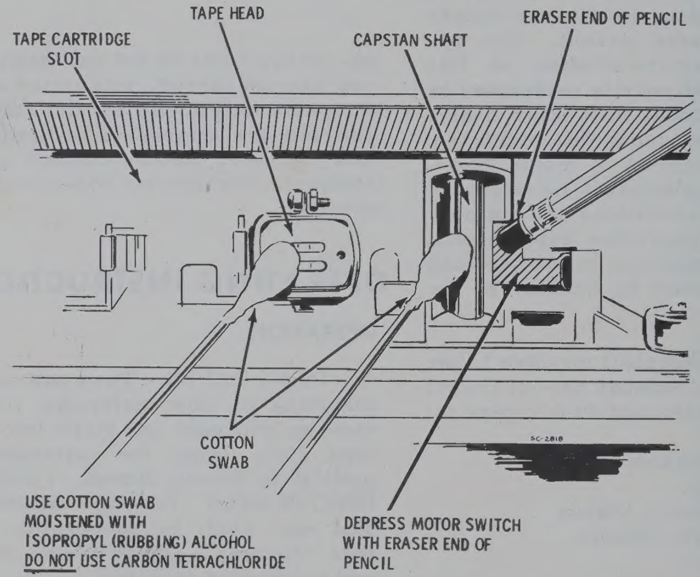
8. TAPE CARTRIDGES - Before servicing the tape player portion of this unit, always check for the possibility of a defective pre-recorded tape cartridge, particularily if one is returned with the unit. This should be done by substituting the tape cartridge with one that is known to be good.

9. TAPE HEAD AND CAPSTAN CLEANING - One major cause of improper tape player operation is oxide build-up on the head and capstan. During normal operation, some iron oxide particules are loosened from the tape and build up. This accumulation of oxide can cause poor playback and up and down tape travel. The head and capstan should be cleaned whenever the unit is serviced and this can be done either in the car or on the service bench. To clean the head and capstan, use a cotton swab moistened with head cleaner or isopropyl alcohol, then wipe dry.

(CAUTION should be exercised when cleaning playback head to prevent getting cleaner on any plastic parts.)



GAINING ACCESS TO PLATED BOARDS, FILTER CHOKE AND OUTPUT TRANSFORMERS



USE COTTON SWAB MOISTENED WITH ISOPROPYL (RUBBING) ALCOHOL
DO NOT USE CARBON TETRACHLORIDE

DEPRESS MOTOR SWITCH WITH ERASER END OF PENCIL

TAPE HEAD & CAPSTAN CLEANING

10. HEAD DEMAGNETIZING - Do not use magnetized screwdrivers and wrenches near the head since these can magnetize the head. The head may also, after a long period of time, acquire some residual magnetism. A head that is magnetized will show a definite loss of high frequency response and an increase in noise level. Use a commercially available head demagnetizer, following instructions included with the unit to demagnetize the head.

11. HEAD REPLACEMENT - The location of the tape head with respect to its mounting bracket is very critical; for this reason, replacement heads are supplied already secured to their mounting bracket and positioned correctly at the factory. When replacing a head, remember to replace it as an assembly, that is, remove the defective head and bracket and replace it with the new head and bracket assembly.

If for some reason the location of the head has changed (due to a loose mounting screw, etc.), position it as shown in "Head Positioning Adjustment".

ADJUSTMENTS AND LUBRICATION

ADJUSTMENTS

Head adjustments are normally required for cases of cross-talk, loss or noisy frequency response or if the head has been replaced.

A suitable test tape should be used for the azimuth and height adjustments. Motorola has a suitable test tape cartridge available for the field under Part Number 99P43309A01. Instructions, in the form of a label on the cartridge, are included.

Connect 8 ohm loads (either speakers or resistors) across the output of both channels and set tone control to treble (maximum clockwise). Use an oscilloscope or AC output meter and a 1/16" Allen wrench for azimuth and height adjustments (Motorola Part Number 66P40059A32).

HEIGHT

This is an adjustment to move the tape head up or down so that it can be positioned exactly in line with the pre-recorded information on the tape. Misadjustment of this screw would cause cross-talk and/or poor separation.

With the Motorola test tape, proceed as follows:

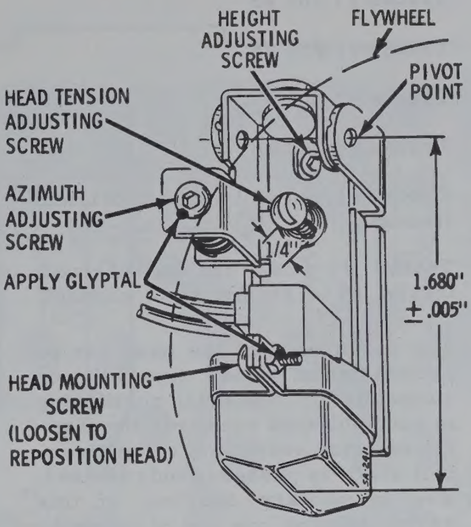
1. Remove top cover and make sure output loads are connected across each channel.

2. Insert test tape cartridge into tape slot and position head to tracks #2 and #6.

3. Set balance control for maximum output from left channel.

4. Connect scope (or VTVM) across left channel output - (track #2 information - 1Kc will be presented). Adjust height adjusting screw for a null. The reason for the null is that the 1Kc information is recorded not on track #2 but on the guard bands adjacent to track #2. This adjustment will minimize cross-talk.

5. Azimuth - Connect scope or VTVM across the output of the right channel and adjust balance control for maximum right channel output - (track #6 information - 8Kc will be presented). Adjust azimuth adjusting screw for maximum output.



HEAD ADJUSTMENTS

6. Repeat Steps #4 and #5 to optimize these adjustments, then cement adjusting screws in place with glyptal (Motorola Part Number 11P40059A53) or other non-hardening cement.

NOTE: Before cementing, index head 4 times and recheck for null; optimize the adjustment.

The next two adjustments are not normally required except when the head has been replaced or tampered with.

HEAD TENSION ADJUSTMENT

This adjustment will have to be made if the head assembly has been replaced. Adjust the screw so that there is 1/4" between the bottom flat of the screw head and the head mounting bracket with head in its lowest position (tracks #4 and #8). Apply glyptal to the screw from the bottom.

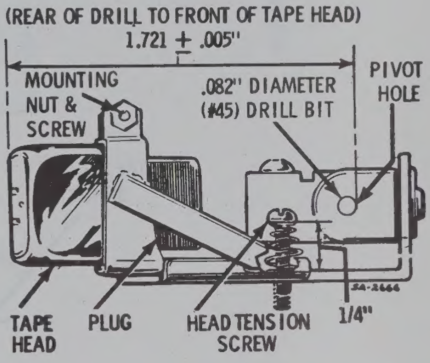
HEAD POSITIONING ADJUSTMENT

Not normally required unless tampering has occurred or if mounting screw has loosened.

The head should be set to 1.680" ± .005" measured from the center of the pivot hole to the front of the head.

Since this dimension is quite critical and may be difficult to gain access to, an alternate method is covered below.

Remove the head and bracket assembly from the tape deck mechanism by first unplugging the cable from the rear of the head, then remove the head tension screw. Loosen the head mounting screw and apply locktite (or other suitable adhesive) to the 4 surfaces of the head where it contacts the bracket. Insert a .082" drill bit (#45 drill) through both pivot holes. With a rule gauge or vernier caliper, adjust the head to 1.721" ± .005" measured from the rear edge of the drill to the front edge of the tape head (see detail). Tighten the head mounting screw and apply glyptal to the mounting nut and screw. Re-install the head and bracket assembly, then adjust the head tension screw to the 1/4" dimension referred to in the detail. Again, apply glyptal to the bottom of this screw. Lastly, perform the azimuth and height adjustments on the head as referred to above.



HEAD POSITIONING

LUBRICATION

Refer to the exploded view on Page 10. The unit is lubricated at the factory and normally no additional lubrication is required; however, if parts are replaced, the following areas should be lubricated with a lightweight, low temperature grease (Motorola Part No. 11P40059A55).

A. Drive surface of cam (39).

B. Ball bearing on end of cam (40).

C. Solenoid plunger (38).

D. Ball bearings in head mounting bracket (63 and 76).

Silicon grease (Dow Corning DC-4 - Motorola Part Number 11M490487) should be applied to the bottom of the capstan shaft (5).

TAPE PLAYER DRIVE AND HEAD POSITIONING

The view shown below is one looking into the tape player from the front with a tape cartridge inserted and operating.

When the tape cartridge is inserted into the tape slot, the front of the tape cartridge activates a micro-switch which, in turn, turns on the tape motor and audio circuitry.

The drive belt on the motor shaft drives the flywheel causing it to rotate. The flywheel shaft (capstan) which presses the tape against the rubber pressure roller (inside the cartridge) drives the tape. The tape guide bracket keeps the tape from riding up and down the head.

Since the pre-recorded tape has four dual channel programs (8 tracks), the head has to be moved to four different height positions with respect to the tape. The sequence of head movement is as follows:

Tracks #1 and #5

Tracks #2 and #6

Tracks #3 and #7

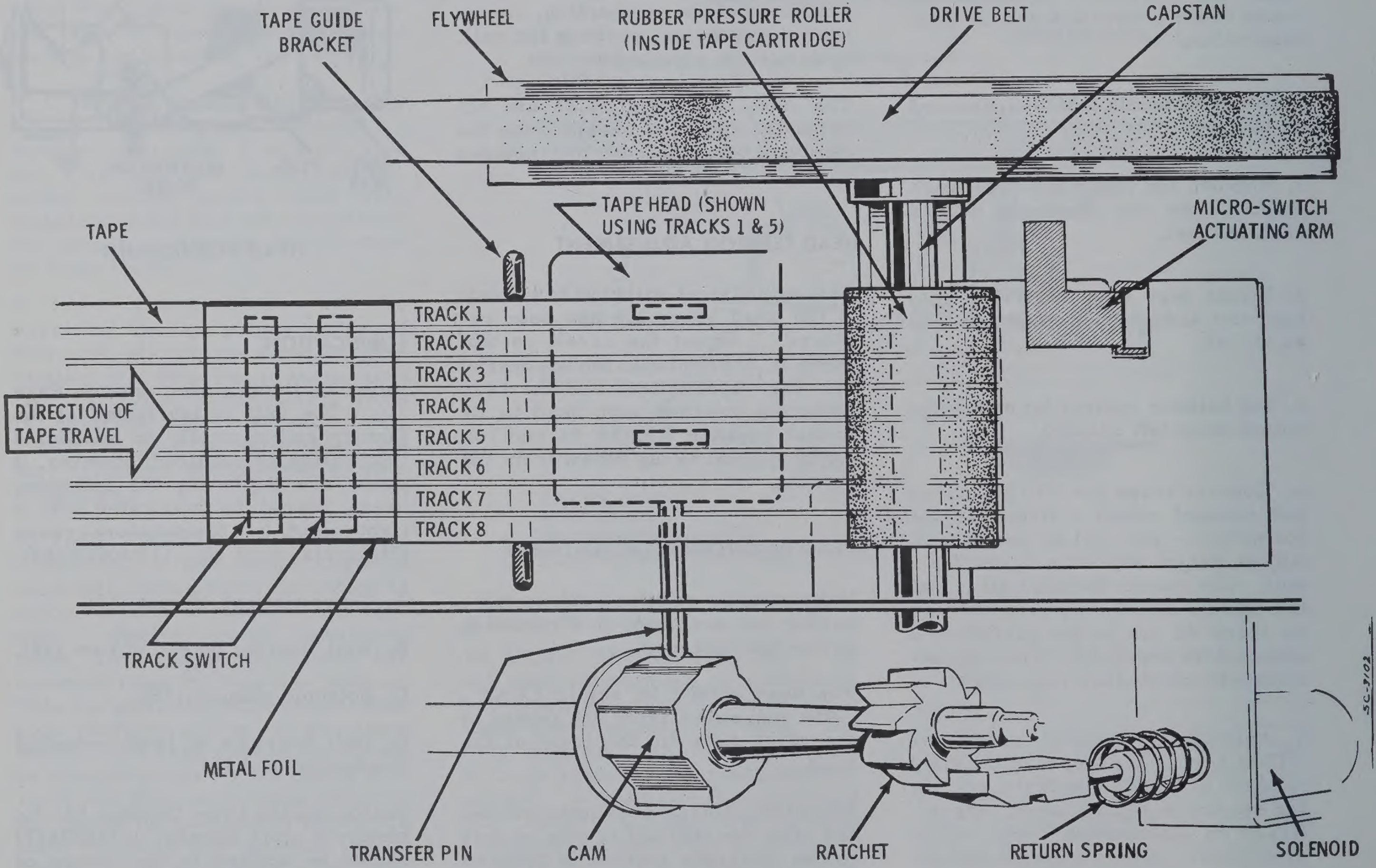
Tracks #4 and #8

Tracks #1 and #5 (return to original tracks)

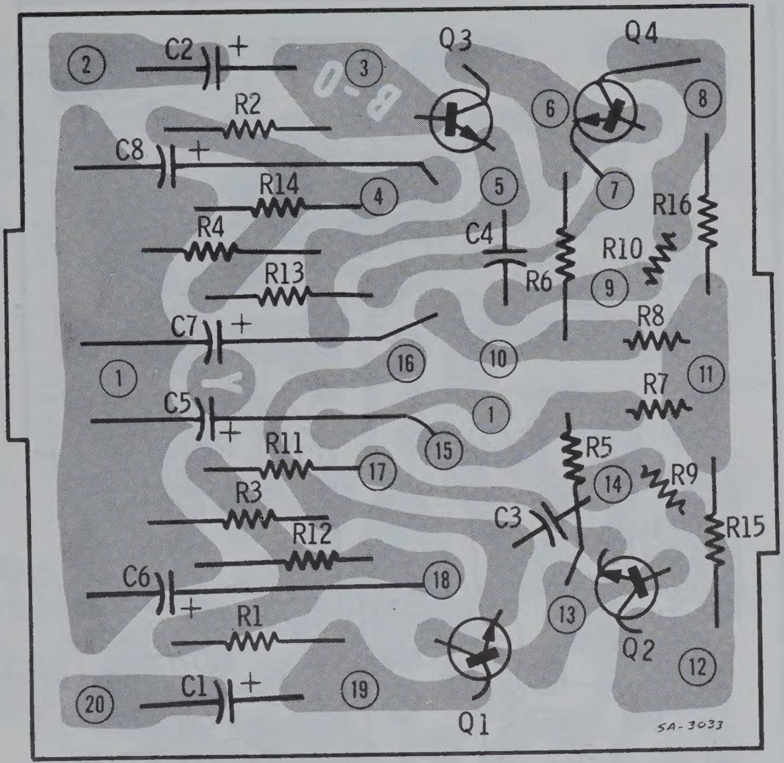
Tracks #1 - #4 are left channel; tracks #5 - #8 are right channel.

The positioning of the head can be accomplished either manually or automatically. Manual positioning is accomplished whenever the channel selector switch (on volume control shaft) is pushed in and released. The momentary shorting of this switch returns one end of the solenoid winding to ground. The resultant magnetic field in the solenoid pulls in the solenoid's spring loaded shaft for an instant; when the shaft returns to its original position, it detents the ratchet end of the cam shaft to its next position. In contact with the irregularly shaped cam is the tape head transfer pin (located beneath the head) which moves the head up or down.

Automatic positioning of the head to the next dual channel program is accomplished by the tape itself when the end of a program is reached. The pre-recorded tape has, at the end of the recorded programs, a strip of metal foil which shorts out the track switch which is in contact with the tape at all times. This switch is wired in parallel with the channel selector switch to start the same action that occurred when the channel selector switch was activated.


TAPE GUIDE BRACKET
FLYWHEEL
RUBBER PRESSURE ROLLER (INSIDE TAPE CARTRIDGE)
DRIVE BELT
CAPSTAN
TAPE HEAD (SHOWN USING TRACKS 1 & 5)
MICRO-SWITCH ACTUATING ARM
TAPE
DIRECTION OF TAPE TRAVEL
TRACK 1
TRACK 2
TRACK 3
TRACK 4
TRACK 5
TRACK 6
TRACK 7
TRACK 8
TRACK SWITCH
METAL FOIL
TRANSFER PIN
CAM
RATCHET
RETURN SPRING
SOLENOID

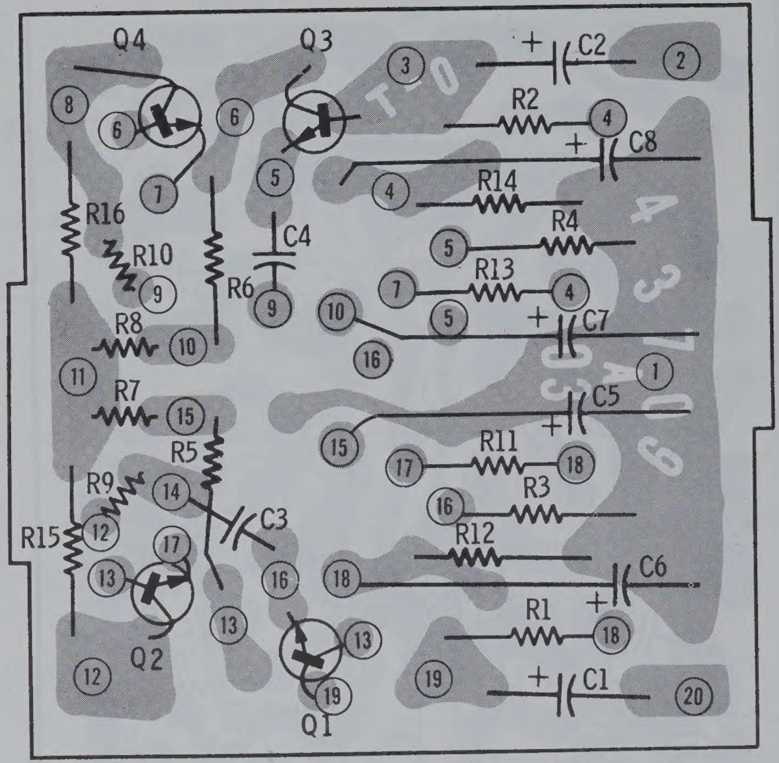
TAPE DRIVE AND HEAD POSITIONING


Q3
Q4
Q1
Q2
C1
C2
C3
C4
C5
C6
C7
C8
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
B-O
Y
SA-3033

TAPE PRE-AMP - BOTTOM VIEW

PLATED CHASSIS REFERENCE POINTS AND PARTS LOCATION

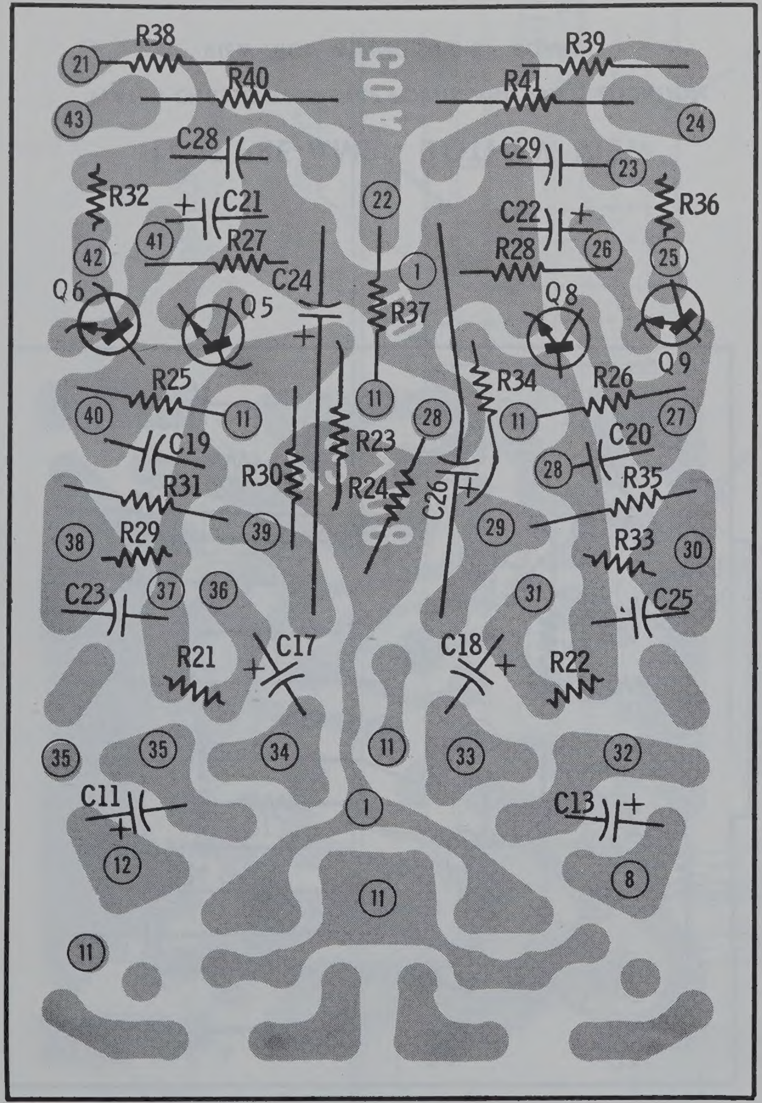
(VIEW FROM WIRING SIDE OF BOARD)


Q4
Q3
Q1
Q2
C1
C2
C3
C4
C5
C6
C7
C8
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
T-O
4 3 7 0 9
A
03

TAPE PRE-AMP - TOP VIEW

PLATED CHASSIS REFERENCE POINTS AND PARTS LOCATION

(VIEW FROM COMPONENT SIDE OF BOARD)


R38
R39
R40
R41
A05
C28
C29
C21
C22
C24
C26
C17
C18
C19
C20
C23
C25
C11
C13
R21
R22
R23
R24
R25
R26
R27
R28
R29
R30
R31
R32
R33
R34
R35
R36
R37
Q5
Q6
Q8
Q9
①
⑧
⑪
⑫
㉑
㉒
㉓
㉔
㉕
㉖
㉗
㉘
㉙
㉚
㉛
㉜
㉝
㉞
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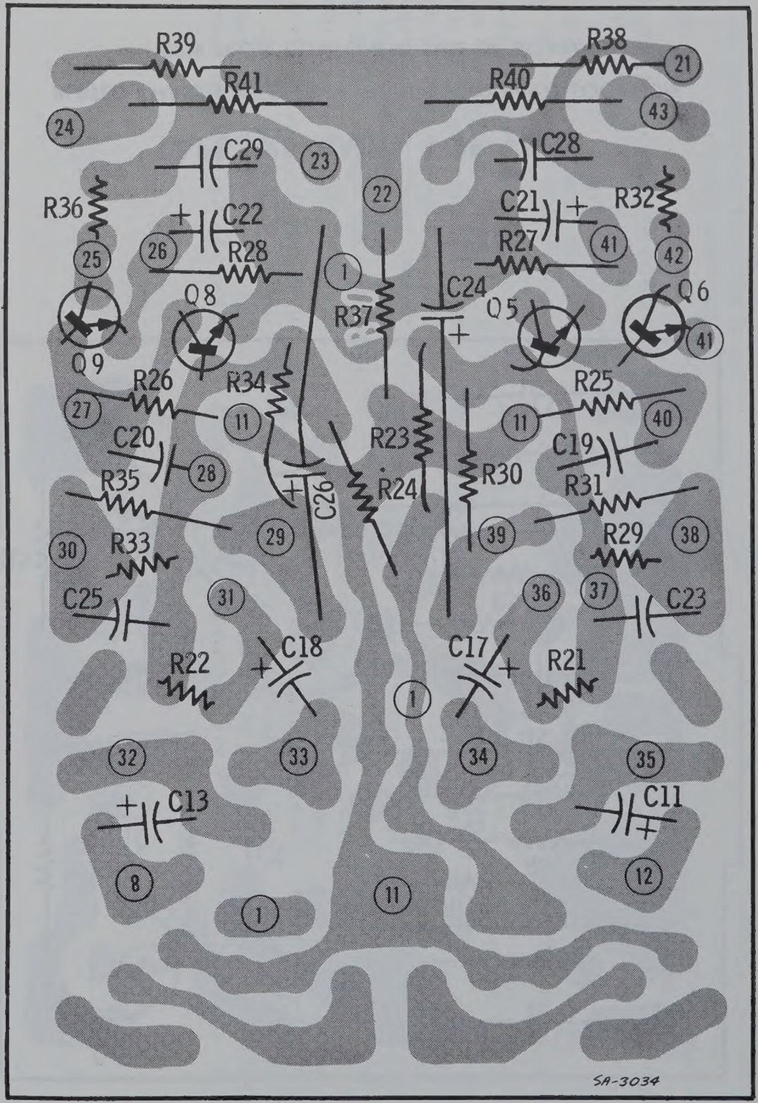
(36)
(37)
(38)
(39)
(40)
(41)
(42)
(43)

AUDIO AMPLIFIER - TOP VIEW

PLATED CHASSIS REFERENCE POINTS AND PARTS LOCATION

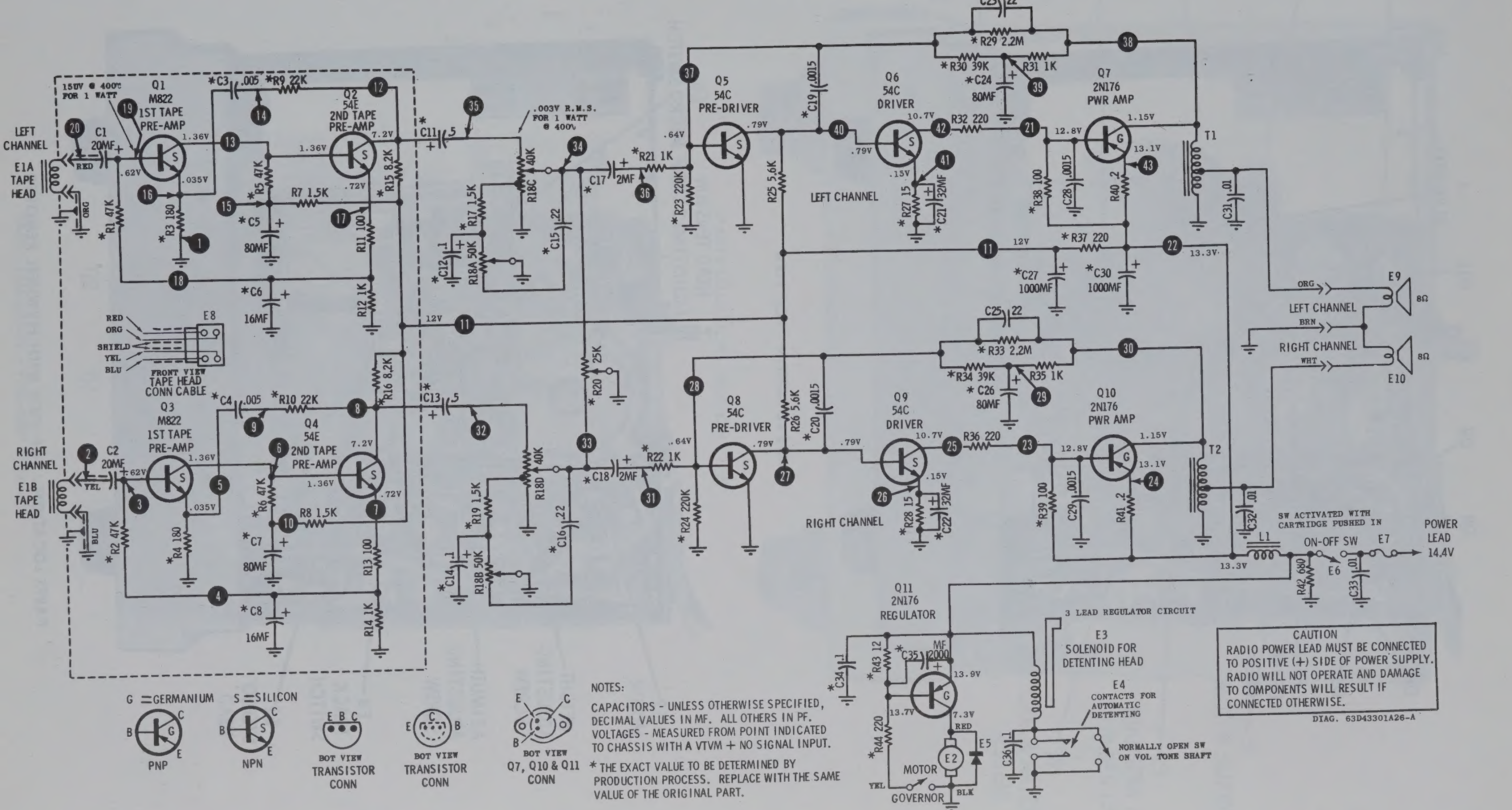
(VIEW FROM COMPONENT SIDE OF BOARD)


R39
R38
R41
R40
C29
C28
C22
C21
C24
C26
C18
C17
C20
C19
C25
C23
C13
C11
R21
R22
R23
R24
R25
R26
R27
R28
R29
R30
R31
R32
R33
R34
R35
R36
R37
Q5
Q6
Q8
Q9
①
⑧
⑪
⑫
㉑
㉒
㉓
㉔
㉕
㉖
㉗
㉘
㉙
㉚
㉛
㉜
㉝
㉞
㉟
(36)
(37)
(38)
(39)
(40)
(41)
(42)
(43)
SA-3034

AUDIO AMPLIFIER - BOTTOM VIEW

PLATED CHASSIS REFERENCE POINTS AND PARTS LOCATION

(VIEW FROM WIRING SIDE OF BOARD)


LEFT CHANNEL
E1A TAPE HEAD
RED
ORG
15UV @ 400~ FOR 1 WATT
C1 20MF
Q1 M822 1ST TAPE PRE-AMP
.62V
1.36V
.035V
*R1 47K
*R3 180
*C3 .005
*R9 22K
Q2 54E 2ND TAPE PRE-AMP
1.36V
7.2V
.72V
*R5 47K
R7 1.5K
*C5 80MF
R11 100
R15 8.2K
*C6 16MF
R12 1K
E8
RED
ORG
SHIELD
YEL
BLU
FRONT VIEW TAPE HEAD CONN CABLE
RIGHT CHANNEL
E1B TAPE HEAD
YEL
BLU
C2 20MF
Q3 M822 1ST TAPE PRE-AMP
.62V
1.36V
.035V
*R2 47K
*R4 180
*C4 .005
*R10 22K
Q4 54E 2ND TAPE PRE-AMP
1.36V
7.2V
.72V
*R6 47K
R8 1.5K
*C7 80MF
R13 100
R16 8.2K
*C8 16MF
R14 1K
12V
*C11 .5
.003V R.M.S. FOR 1 WATT @ 400~
R18C 40K
*C12 .1
*R17 1.5K
R18A 50K
*C15 .22
*C17 2MF
*R21 1K
*R20 25K
*C13 .5
R18D 40K
*C14 .1
*R19 1.5K
R18B 50K
*C16 .22
*C18 2MF
*R22 1K
Q5 54C PRE-DRIVER
.64V
.79V
*R23 220K
R25 5.6K
*C19 .0015
Q6 54C DRIVER
10.7V
.79V
.15V
R32 220
*R27 15
*C21 32MF
LEFT CHANNEL
C23 22
*R29 2.2M
*R30 39K
R31 1K
*C24 80MF
Q7 2N176 PWR AMP
12.8V
1.15V
13.1V
*R38 100
C28 .0015
R40 .2
12V
*R37 220
*C27 1000MF
*C30 1000MF
13.3V
T1
C31 .01
ORG
LEFT CHANNEL
BRN
RIGHT CHANNEL
WHT
E9 8Ω
E10 8Ω
Q8 54C PRE-DRIVER
.64V
.79V
*R24 220K
R26 5.6K
*C20 .0015
Q9 54C DRIVER
10.7V
.79V
.15V
R36 220
*R28 15
*C22 32MF
RIGHT CHANNEL
C25 22
*R33 2.2M
*R34 39K
R35 1K
*C26 80MF
Q10 2N176 PWR AMP
12.8V
1.15V
13.1V
*R39 100
C29 .0015
R41 .2
T2
C32 .01
L1
13.3V
SW ACTIVATED WITH CARTRIDGE PUSHED IN
ON-OFF SW
E6
E7
POWER LEAD 14.4V
R42 680
C33 .01
Q11 2N176 REGULATOR
*C34 .1
*R43 12
*C35 MF 2000
13.9V
13.7V
7.3V
*R44 220
RED
E2
E5
MOTOR
YEL
BLK
GOVERNOR
3 LEAD REGULATOR CIRCUIT
E3 SOLENOID FOR DETENTING HEAD
E4
CONTACTS FOR AUTOMATIC DETENTING
C36 .1
NORMALLY OPEN SW ON VOL TONE SHAFT
G = GERMANIUM
S = SILICON
PNP
NPN
E B C
BOT VIEW TRANSISTOR CONN
BOT VIEW TRANSISTOR CONN
BOT VIEW Q7, Q10 & Q11 CONN
DIAG. 63D43301A26-A
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43

NOTES:

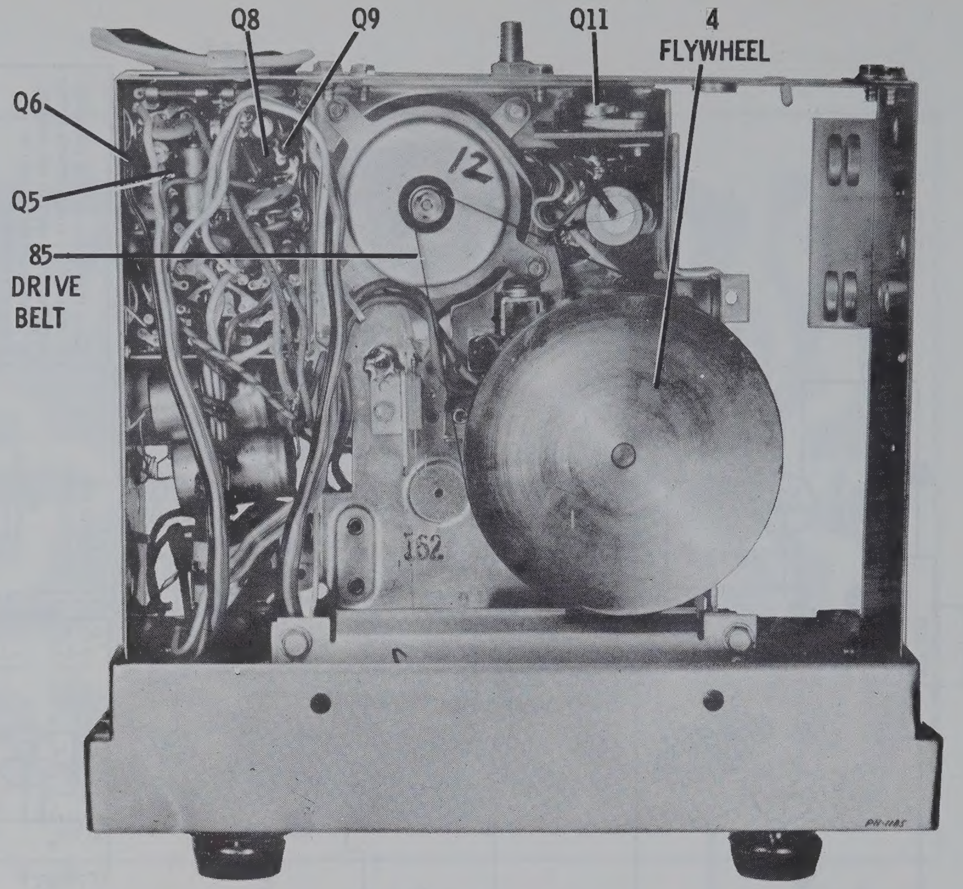
CAPACITORS - UNLESS OTHERWISE SPECIFIED, DECIMAL VALUES IN MF. ALL OTHERS IN PF.
VOLTAGES - MEASURED FROM POINT INDICATED TO CHASSIS WITH A VTVM + NO SIGNAL INPUT.

* THE EXACT VALUE TO BE DETERMINED BY PRODUCTION PROCESS. REPLACE WITH THE SAME VALUE OF THE ORIGINAL PART.

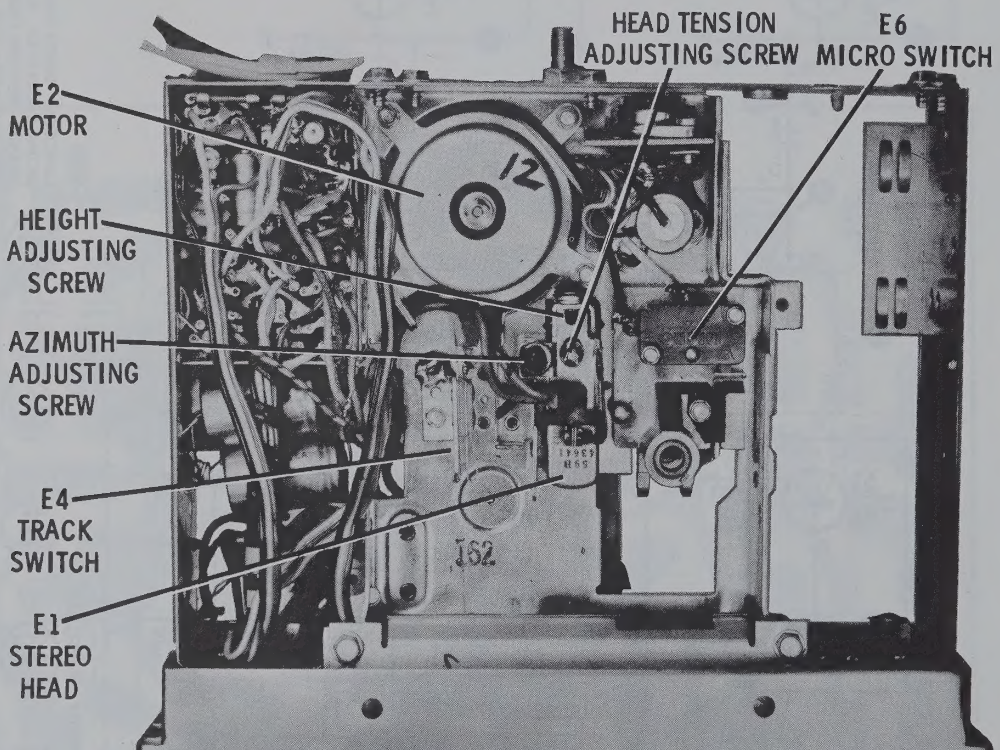
CAUTION

RADIO POWER LEAD MUST BE CONNECTED TO POSITIVE (+) SIDE OF POWER SUPPLY. RADIO WILL NOT OPERATE AND DAMAGE TO COMPONENTS WILL RESULT IF CONNECTED OTHERWISE.

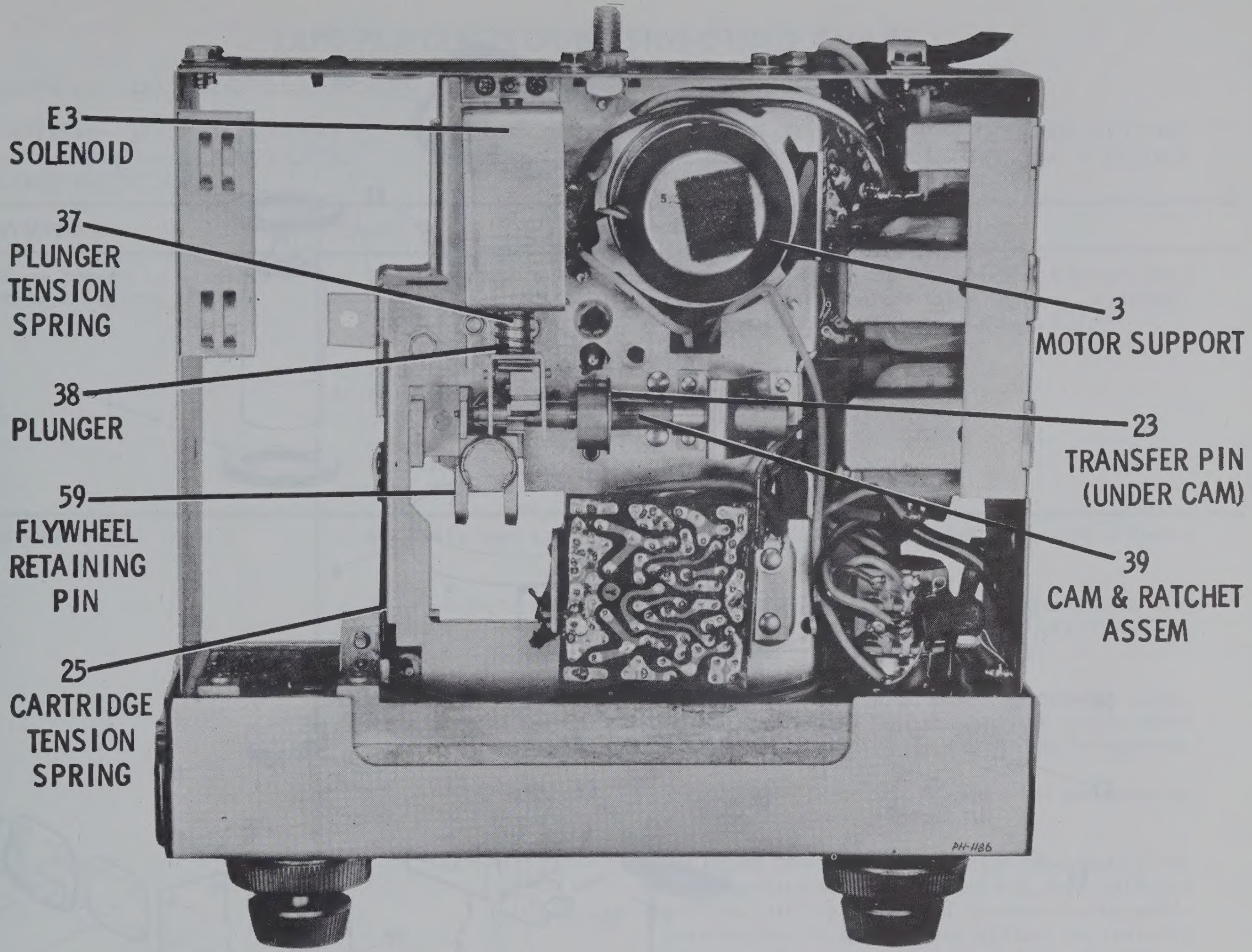
SCHEMATIC DIAGRAM


Q6
Q5
85
DRIVE
BELT
Q8
Q9
Q11
4
FLYWHEEL
PH-1185

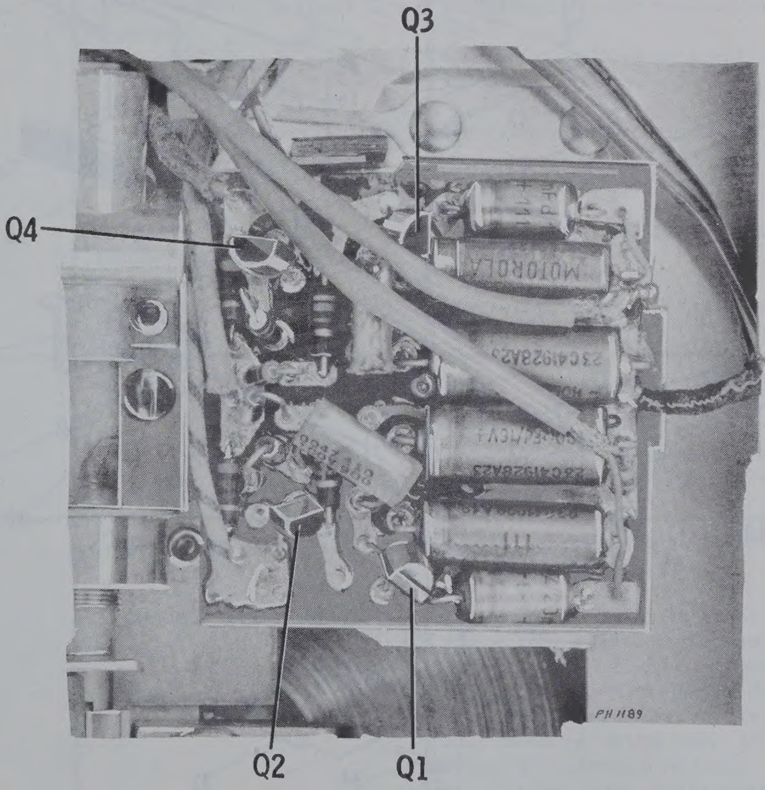
PARTS LOCATION - TOP VIEW


E2
MOTOR
HEIGHT
ADJUSTING
SCREW
AZIMUTH
ADJUSTING
SCREW
E4
TRACK
SWITCH
E1
STEREO
HEAD
HEAD TENSION
ADJUSTING SCREW
E6
MICRO SWITCH
PH-1184

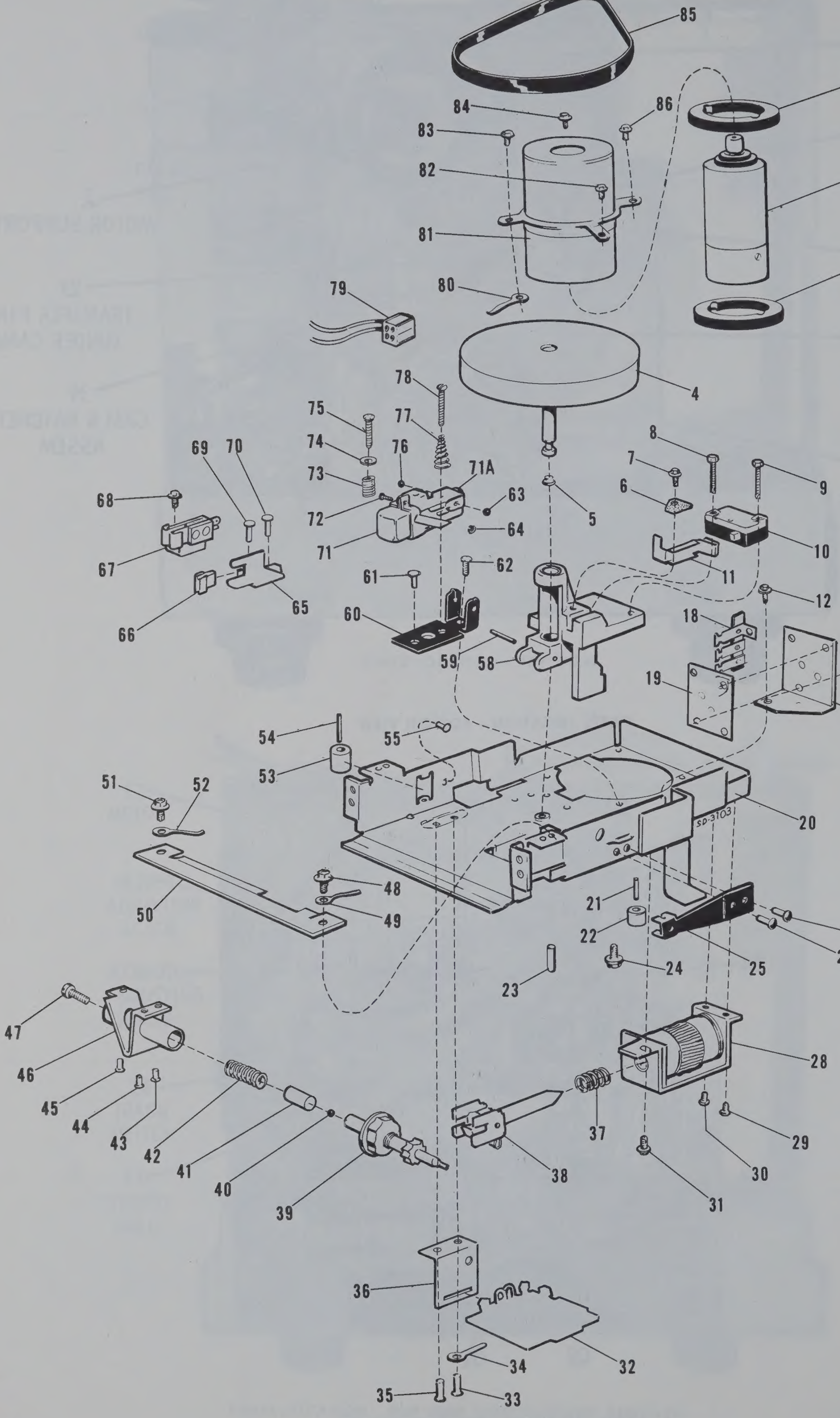
PARTS LOCATION - TOP VIEW WITH FLYWHEEL REMOVED


E3
SOLENOID
37
PLUNGER TENSION SPRING
38
PLUNGER
59
FLYWHEEL RETAINING PIN
25
CARTRIDGE TENSION SPRING
3
MOTOR SUPPORT
23
TRANSFER PIN (UNDER CAM)
39
CAM & RATCHET ASSEM
PH-1186

PARTS LOCATION - BOTTOM VIEW


Q3
Q4
Q2
Q1
MOTOROLA
PH 1189

PARTS LOCATION - PRE-AMP CHASSIS


85
1
84
86
83
2
82
81
3
79
80
4
78
75
77
74
76
71A
73
72
63
71
64
69
70
68
67
66
65
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62
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54
55
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52
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48
49
20
SD-3103
21
22
27
26
25
24
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33

EXPLODED VIEW OF TAPE DECK PARTS

TAPE PLAYER TROUBLESHOOTING CHART

NOTE #1: DO NOT OPERATE TAPE PLAYER UPSIDE DOWN - CARTRIDGE MAY JAM.

NOTE #2: MANY TAPE PLAYER PROBLEMS CAN BE CAUSED BY DEFECTIVE CARTRIDGES; BEFORE SERVICING THE TAPE PLAYER, CHECK FOR A DEFECTIVE CARTRIDGE BY SUBSTITUTING A KNOWN GOOD CARTRIDGE.

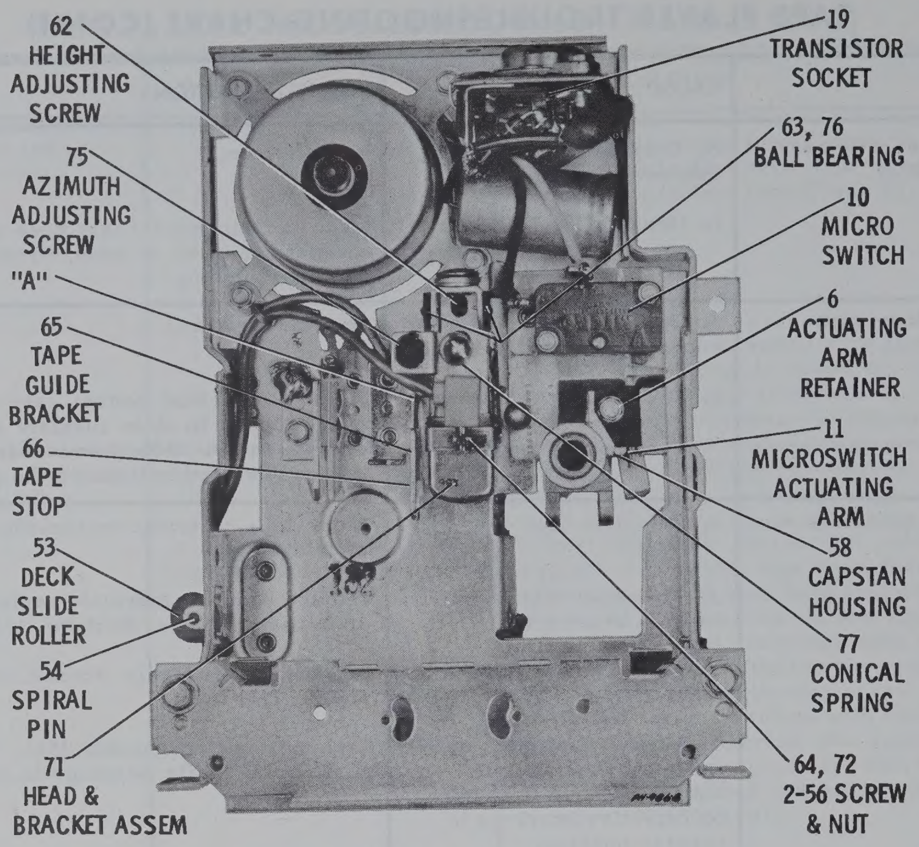
SYMPTOM	CAUSE	POSSIBLE SOLUTION
Tape breaks or winds up around capstan shaft.	1. Defective tape cartridge.	Check tape cartridge by inserting a known good tape cartridge. Before inserting new cartridge, examine actuating arm (see Cause #2).
	2. Bent or burred edge on front of micro-switch actuating arm (11).	Replace arm.
	3. Defective capstan housing (58).	Replace capstan housing.
Cross-talk.	1. Defective tape cartridge.	Check tape cartridge by substitution with a known good tape cartridge.
	2. Tape head (71) out of adjustment.	Check head height and azimuth adjustments with a test tape (Motorola Part No. 99P43309A01) as outlined in "Adjustments" section.
	3. Head mounting bracket (71A) binding.	Grasp at rear of head mounting bracket with a pair of long nose pliers and squeeze gently while moving head up and down until binding is relieved. CAUTION: Do not apply excessive pressure as ball bearings may pop out. To check this adjustment, index tape head to its lowest position (tracks #4 and #8), then with unit vertical, lift up tape head; it should have sufficient tension to spring back against the transfer pin without binding. Also check for 1/4" adjustment of head tension adjusting screw (see "Adjustments").
	4. Tape guide bracket (65) not positioning tape correctly with respect to tape head.	Check distance between bottom edge of tape guide bracket and chassis; it should be .090" - .095". If it is not, bend or replace the tape guide bracket. CAUTION: Bend at point "A" not at the two (2) tines (see photo).
	5. Thrust plate on bottom of capstan housing (58) loose or missing.	Replace capstan housing.
	6. Defective cam and ratchet assembly (39).	Replace cam and ratchet assembly.
	7. Tape head not indexing correctly.	See "Improper or Erratic Head Indexing".
Motor runs fast.	1. Defect in regulator circuitry.	Check regulator transistor by shorting base to emitter of regulator transistor (to remove forward bias), motor should stop; if it does not, regulator transistor is shorted.
	2. Defective motor (2).	Replace.
Slow speed (also see "Poor Tape Drive").	1. Defective tape cartridge.	Check tape cartridge by inserting a known good cartridge.
	2. Mechanical binding.	Check for binding by first removing tape cartridge, turn on motor with micro-switch actuating arm and check flywheel speed with a strobe disc (Motorola Part Number 68P40059A33 or equivalent). If speed is excessively slow, shut off unit and remove drive belt; flywheel should move freely when turned by hand. If it does not, check for missing nylon bearing on bottom of flywheel, loose or missing thrust plate at bottom of capstan housing, defective bearings in capstan housing or defective flywheel.

TAPE PLAYER TROUBLESHOOTING CHART (CON'T)

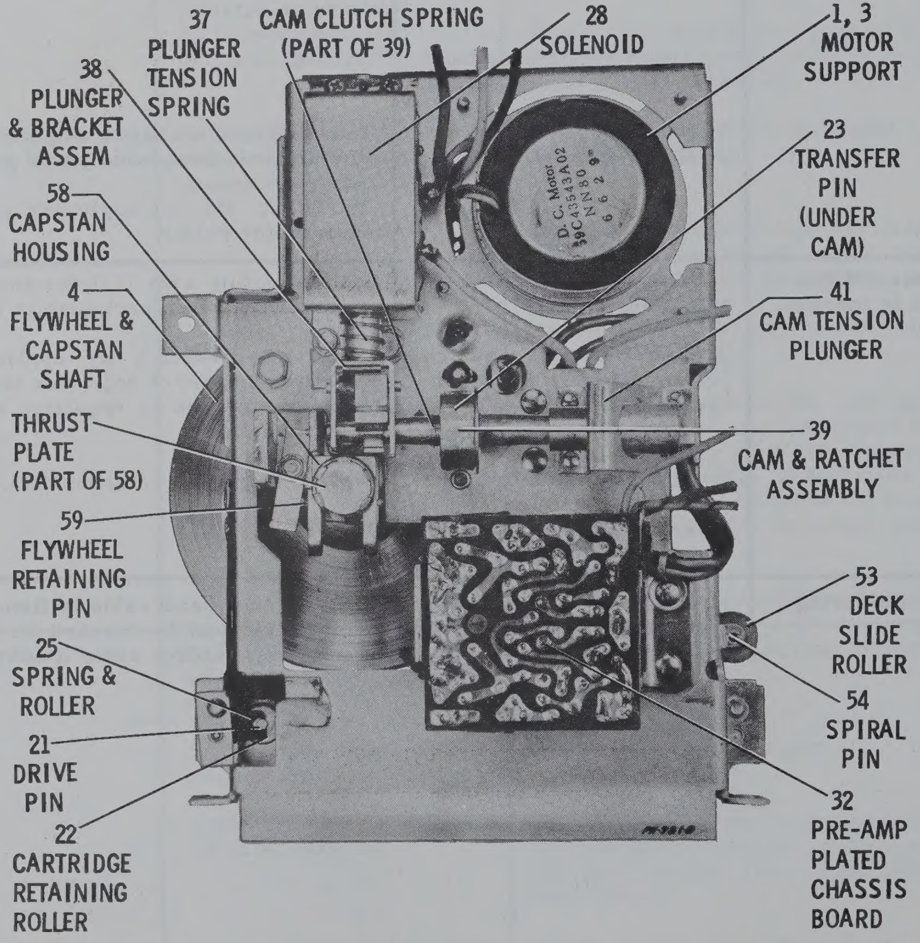
SYMPTOM	CAUSE	POSSIBLE SOLUTION
Slow speed (also see "Poor Tape Drive"). (Cont'd)		If flywheel moves freely when turned by hand, check for defective drive belt, tape cartridge or electrical problem (see Cause #3).
	3. Electrical defects. A. Open regulator filter capacitor (C-35).	Replace C-35.
	B. Defective motor (2).	Check motor by grounding motor governor (junction of yellow motor wire and R-44) for an instant, motor should speed up; if motor does not speed up, motor is defective. If motor does speed up, check voltages in regulator circuitry.
Poor tape drive, wow and flutter (also see "Slow Speed").	1. Defective tape cartridge.	Check tape cartridge by inserting a known good tape.
	2. Insufficient tension on tape cartridge.	Check cartridge tension by pulling cartridge slightly away from tape head, then release; the cartridge should snap back into place and there should be no end play on the right side of the cartridge. If the cartridge does not snap in or there is end play, replace the spring and roller (25). Make sure mounting screw does not protrude too far to interfere with cartridge. Also, with cartridge inserted, the roller (53) on the left side should be in contact with the cartridge. If it is not, replace the roller (Motorola Part Number 49A43659A03).
	3. Flywheel (4) and/or motor drive shaft (part of 2) dirty or greasy.	Use isopropyl (rubbing) alcohol to clean the following areas: outer edge of flywheel, motor drive shaft and capstan shaft.
	4. Defective or incorrectly installed drive belt (85).	Drive belt should be replaced if stretched or banana shaped; belt should be installed with paint stripe on outside.
	5. Cartridge retaining roller (22) not seated properly or missing.	Make certain roller is seated in spring (25); replace if missing.
	6. Scraping cartridge.	Examine left side of tape cartridge; if severely scored, lightly file off any burrs on left front edge of tape slot or escutcheon.
	7. Scored capstan shaft (part of 4).	Replace; if severely scored, replace capstan housing (58) also.
	8. Bent motor housing (81).	With cartridge inserted and operating, make certain drive belt rides on center of brass motor pulley; bend the motor housing using wide jawed pliers if necessary. If belt rides too high, bend the housing away from the capstan; if belt rides too low (rubs against housing), bend the housing toward the capstan. CAUTION: Do not bend the brass motor pulley.
Improper or erratic head indexing.	1. Inadequate tension on solenoid plunger tension spring (37).	Increase tension on spring or replace.
	2. Defective solenoid plunger (38).	Replace solenoid plunger.
	3. Head tension screw (78) out of adjustment.	Set the height of the screw so that there is 1/4" between bottom flat portion of the screw head and the head bracket (see "Head Adjustment Location" detail).
	4. Cam clutch spring (part of 39) out of hole or missing.	Insert spring into its hole or replace cam if spring is missing.

TAPE PLAYER TROUBLESHOOTING CHART (CON'T)

SYMPTOM	CAUSE	POSSIBLE SOLUTION
Improper or erratic head indexing (Cont'd)	5. Defective cam and ratchet assembly (39).	Replace cam.
	6. Head cable (79) binding.	Make certain head cable does not restrict up-and-down motion of head; dress head cable to minimize binding.
Motor noise from tape motor.	1. Open regulator filter capacitor (C-35).	Replace capacitor.
	2. Motor grounded to cover.	Check to see that bottom cover has an armite disc attached to it to insulate the motor case from the cover. If the disc is missing, electrical tape can be used to insulate the motor.
Squeaking or excessive wow.	1. Defective tape cartridge.	Check tape cartridge by inserting a known good cartridge.
	2. Broken or missing nylon capstan bearing (5).	Replace bearing; lubricate replacement bearing with silicon grease, Part No. 11M490487.
	3. Scored capstan shaft (part of 4).	Replace; if severely scored, replace capstan housing (58) also.
	4. Thrust plate (part of 58) loose or missing from bottom of capstan housing or defective bearings in capstan housing.	Replace capstan housing (58). Do not attempt to lubricate oilite bearings in capstan housing.
Drive belt slips off flywheel (also slow tape start up).	1. Defective or incorrectly installed drive belt (85).	Drive belt should be replaced if stretched or banana shaped; belt should be installed with paint stripe on outside.
	2. Loose motor mounting screws (82, 83, 84 and 86).	Tighten.
	3. Motor drive shaft (part of 2) not vertical.	Bend the motor housing slightly away from the capstan shaft using wide jawed pliers. CAUTION: Do not apply any pressure to the brass motor pulley.
Tape motor does not run when cartridge is inserted.	1. Micro-switch (10) not activated.	Bend actuating arm (11) far enough to activate micro-switch when cartridge is inserted.
	2. Defective micro-switch (10) or defect in motor or regulator circuit.	Check micro-switch by applying B+ voltage directly to emitter of regulator transistor. Also compare voltages in regulator circuit to those on schematic.
	3. Shorted regulator filter capacitor (C-35) or defective regulator transistor.	Replace suspected component(s).
Intermittent audio during tape operation.	1. Loose or intermittent head cable (79).	Make certain head cable is firmly plugged into head. Cable can be checked for intermittent(s) by wiggling; replace cable if necessary.


62
HEIGHT
ADJUSTING
SCREW
75
AZIMUTH
ADJUSTING
SCREW
"A"
65
TAPE
GUIDE
BRACKET
66
TAPE
STOP
53
DECK
SLIDE
ROLLER
54
SPIRAL
PIN
71
HEAD &
BRACKET ASSEM
19
TRANSISTOR
SOCKET
63, 76
BALL BEARING
10
MICRO
SWITCH
6
ACTUATING
ARM
RETAINER
11
MICROSWITCH
ACTUATING
ARM
58
CAPSTAN
HOUSING
77
CONICAL
SPRING
64, 72
2-56 SCREW
& NUT

TOP VIEW


37
PLUNGER
TENSION
SPRING
CAM CLUTCH SPRING
(PART OF 39)
28
SOLENOID
1, 3
MOTOR
SUPPORT
38
PLUNGER
& BRACKET
ASSEM
58
CAPSTAN
HOUSING
4
FLYWHEEL &
CAPSTAN
SHAFT
THRUST
PLATE
(PART OF 58)
59
FLYWHEEL
RETAINING
PIN
25
SPRING &
ROLLER
21
DRIVE
PIN
22
CARTRIDGE
RETAINING
ROLLER
D. C. Motor
39C43543A02
NN80
6 6 2 9
23
TRANSFER
PIN
(UNDER
CAM)
41
CAM TENSION
PLUNGER
39
CAM & RATCHET
ASSEMBLY
53
DECK
SLIDE
ROLLER
54
SPIRAL
PIN
32
PRE-AMP
PLATED
CHASSIS
BOARD

BOTTOM VIEW

TAPE DECK PARTS LOCATION

REPLACEMENT PARTS LIST

Ref. No.	Part Number	Description	List Price
		ELECTRICAL PARTS	
CAPACITORS - NOTE: The capacitors in this list are recommended replacement types for the original equipment; all are ceramic disc type unless otherwise specified.			
C-1 thru C-8	---	SEE TAPE DECK PARTS	
C-11	23C43280A21	.5 mf +40-20% 15V lytic.	.30
C-12	23C43280A14	.1 mf 15V lytic..........	.35
C-13	23C43280A21	.5 mf +40-20% 15V lytic.	.30
C-14	23C43280A14	.1 mf 15V lytic..........	.35
C-15	21C41680A15	.22 mf +80-20% 12V.......	.35
C-16	21C41680A15	.22 mf +80-20% 12V.......	.35
C-17	23C43280A02	2 mf +40-20% 10V lytic..	.45
C-18	23C43280A02	2 mf +40-20% 10V lytic..	.45
C-19	21D40339A87	.0015 mf 10% 100V........	.20
C-20	21D40339A87	.0015 mf 10% 100V........	.20
C-21	23C41928A33	32 mf 10V lytic..........	.65
C-22	23C41928A33	32 mf 10V lytic..........	.65
C-23	21D40536A50	22 pf 10% 100V N150 (USE 21S120539)...........	.25
C-24	23C41928A23	80 mf 16V lytic..........	.65
C-25	21D40536A50	22 pf 10% 100V N150 (USE 21S120539)...........	.25
C-26	23C41928A23	80 mf 16V lytic..........	.65
C-27	23C41928A29	1000 mf 16V lytic.......	1.65
C-28	21D40339A87	.0015 mf 10% 100V........	.20
C-29	21D40339A87	.0015 mf 10% 100V........	.20
C-30	23C41928A29	1000 mf 16V lytic.......	1.65
C-31	21D40339A78	.01 mf +80-20% 100V (USE 21S132103)...........	.25
C-32	21D40339A78	.01 mf +80-20% 100V (USE 21S132103)...........	.25
C-33	21D40339A78	.01 mf +80-20% 100V (USE 21S132103)...........	.25
C-34, C-35	---	SEE TAPE DECK PARTS	
C-36	8C40906A05	.1 mf 20% 100V mylar....	.35
MISCELLANEOUS ELECTRICAL PARTS			
E-1 thru E-6	---	SEE TAPE DECK PARTS	
E-7	65R122346	FUSE, 7.5 amp..............	.07
E-8	---	SEE TAPE DECK PARTS	
E-9	50C40740B01	SPEAKER, 5-1/4 PM: 8Ω VC...	8.40
E-10	50C40740B01	SPEAKER, 5-1/4 PM: 8Ω VC...	8.40
COILS & CHOKES			
L-1	25D43221A24	CHOKE, filter.............	3.95
RESISTORS & CONTROLS			
R-1 thru R-16	---	SEE TAPE DECK PARTS	
R-17	6S127803	1500 10% 1/4W...........	.17
R-18	18C40483B02	CONTROL, multiple..........	9.60
R-19	6S127803	1500 10% 1/4W...........	.17
R-20	18B40482B01	CONTROL, balance...........	1.30
R-21	6S127802	1000 10% 1/4W...........	.17
R-22	6S127802	1000 10% 1/4W...........	.17
R-23	6S129147	220K 10% 1/4W...........	.17
R-24	6S129147	220K 10% 1/4W...........	.17
R-25	6S129433	5600 10% 1/4W...........	.17
R-26	6S129433	5600 10% 1/4W.............	.17
R-27	6S131377	15 10% 1/4W..............	.17
R-28	6S131377	15 10% 1/4W..............	.17
R-29	6S127001	2.2 meg 10% 1/2W.........	.17
R-30	6S128903	39K 10% 1/4W............	.17
R-31	6S121301	1000 10% 1/2W...........	.17
R-32	6S127800	220 10% 1/4W............	.17
R-33	6S127001	2.2 meg 10% 1/2W.........	.17
R-34	6S128903	39K 10% 1/4W............	.17
R-35	6S121301	1000 10% 1/2W...........	.17
R-36	6S127800	220 10% 1/4W............	.17
R-37	6S127099	220 10% 1/2W............	.17
R-38	6S129753	100 10% 1/4W............	.17
R-39	6S129753	100 10% 1/4W............	.17
R-40	17B40756A04	.20 5% WW PTC (USE 17B40756A06)	
R-41	17B40756A04	.20 5% WW PTC (USE 17B40756A06).........	.25
R-42	6S129101	680 10% 1/2W............	.17
R-43, R-44	---	SEE TAPE DECK PARTS	
TRANSFORMERS			
T-1	25D41307B05	OUTPUT.....................	1.55
T-2	25D41307B07	OUTPUT.....................	1.55
TRANSISTORS			
Q-1 thru Q-4	---	SEE TAPE DECK PARTS	
Q-5	48S134810	54C........................	1.45
Q-6	48S134810	54C........................	1.45
Q-7	48S134747	2N176......................	3.25
Q-8	48S134810	54C........................	1.45
Q-9	48S134810	54C........................	1.45
Q-10	48S134747	2N176......................	3.25
Q-11	---	SEE TAPE DECK PARTS	
		MECHANICAL PARTS	
	84D43708A05	BOARD, plated chassis: audio less all components........	2.10
	3A40730A03	BOLT, spcl: 1/4-20; sq. hd (radio mtg)............	.03
	*59T41437B01	CARTRIDGE, stereo tape......	
	15D40565B01	COVER, bottom: player.......	.70
	15D40686B01	COVER, radio trim: blk......	1.20
	15D40563B01	COVER, top: player..........	.65
	15C40570B01	DOOR, tape cartridge........	.55
	*13D41017B04	ESCUTCHEON, trim: less nameplate.................	8.60
	13C40658B01	GRILLE, speaker.............	1.60
	15C40810B01	HOUSING, spkr...............	1.95
	14A543810	INSULATOR, trans............	.10
	36K565237	KNOB, pendant...............	.95
	36B564318	KNOB, vol-bal-channel chge..	.90
	*33B41436B01	NAMEPLATE, "International"..	.55
	2B43951A01	NUT, clip-on: #8-15 (spkr mtg to hsg)...............	.03
	2S135435	NUT, hex: 1/4-20 (to secure mtg bolt)..........	.03
	2S124821	NUT, hex: 1/2-28 (player mtg to front escut)........	.15
	9C41095A26	RECEPTACLE, fuse: incl fuse......................	1.00
	47A43513A02	ROD, cartridge door.........	.15
	3K560695	SCREW, spcl: trans mtg......	.03
	3B40410A07	SCREW, tpg: #8-15 x 1-1/4 (spkr mtg to hsg)..........	.10
	9C43089A01	SOCKET, trans...............	.25
	41A43588A01	SPRING, cartridge door......	.15
	46K565358	STUD, trimount: trim cover.	.10
		INSTALLATION PARTS	
	*1V41300B75	PLAYER INSTALLATION KIT.....	3.60
	7A40566B02	BRACKET, player mtg.........	.15
	9A60992A01	CONNECTOR, wire: plastic...	.05
	2S135435	NUT, hex: 1/4-20 (rear player mtg)................	.03
	2S115123	NUT, lock: 10-32 x 3/8......	.10
	3S125927	SCREW, mach: 10-32 x 3/8; SL HEX (mts player to brkt floor mtg)................	.03
	3S135712	SCREW, tpg: #8-32 x 1/4; pol chr (player brkt to escut)....................	.05
	3S135757	SCREW, tpg: 10-12 x 1/2 (spkr hsg to dash)........	.03
	3S135885	SCREW, tpg: 10-12 x 1; SL HEX HD (mts bracket to floor - floor mtg).....	.05
	42K565362	STRAP, radio mtg...........	.30
		WTD-90 TAPE DECK	
		ELECTRICAL PARTS	
CAPACITORS - NOTE: The capacitors in this list are recommended replacement types for the original equipment; all are ceramic disc type unless otherwise specified.			
C-1	23C41928A24	20 mf 16V lytic..........	.65
C-2	23C41928A24	20 mf 16V lytic..........	.65
C-3	8C42750A20	.005 mf 10% 100V mylar (USE 8C40906A27)..........	.30
C-4	8C42750A20	.005 mf 10% 100V mylar (USE 8C40906A27)..........	.30
C-5	23C41928A23	80 mf 16V lytic...........	.65
C-6	23C41928A06	16 mf 16V lytic...........	.90

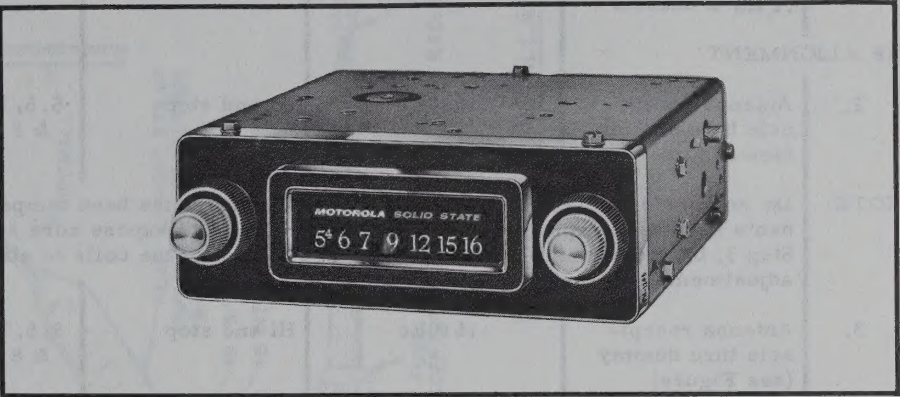
Ref. No.	Part Number	Description	List Price
C-7	23C41928A23	80 mf 16V lytic	.65
C-8	23C41928A06	16 mf 16V lytic	.90
C-34	8C40906A05	.1 mf 20% 100V mylar	.35
C-35	23C41928A30	2000 mf 4V lytic	1.25
MISCELLANEOUS ELECTRICAL PARTS			
E-1	1V40800B98	STEREO HEAD & MTG BRKT ASSEM	14.50
E-2	59C43543A02	MOTOR, regulated DC	18.75
E-3	80B43685A01	SOLENOID	3.70
E-4	40B43642A01	SWITCH, leaf contact	1.20
E-5	48A41508A01	RECTIFIER, silicon	.80
E-6	40B43677A01	SWITCH, micro	2.00
E-8	30C40643B02	CABLE, stereo head	1.35
RESISTORS			
R-1	6S128902	47K 10% 1/4W	.17
R-2	6S128902	47K 10% 1/4W	.17
R-3	6S129662	180 10% 1/4W	.17
R-4	6S129662	180 10% 1/4W	.17
R-5	6S128902	47K 10% 1/4W	.17
R-6	6S128902	47K 10% 1/4W	.17
R-7	6S127513	1500 10% 1/2W	.17
R-8	6S127513	1500 10% 1/2W	.17
R-9	6S125568	22K 10% 1/2W	.17
R-10	6S125568	22K 10% 1/2W	.17
R-11	6S129753	100 10% 1/4W	.17
R-12	6S127802	1000 10% 1/4W	.17
R-13	6S129753	100 10% 1/4W	.17
R-14	6S127802	1000 10% 1/4W	.17
R-15	6S128686	8200 10% 1/4W	.17
R-16	6S128686	8200 10% 1/4W	.17
R-43	6S128224	12 10% 1/2W	.17
R-44	6S127099	220 10% 1/2W	.17
TRANSISTORS			
Q-1	48S134823	M822	1.50
Q-2	48S134846	54E	1.50
Q-3	48S134823	M822	1.50
Q-4	48S134846	54E	1.50
Q-11	48S134746	2N176 (USE 48S134747)	3.25
		MECHANICAL PARTS	
1	7A43576A01	SUPPORT, motor: rubber	.15
2	---	SEE E-2 IN ELECTRICAL PARTS	
3	7A43576A01	SUPPORT, motor: rubber	.15
4	49B43791A01	FLYWHEEL & SHAFT ASSEM	9.25
5	43A43867A01	BEARING, nylon: flywheel assem	.05
6	26A40607B01	RETAINER, actuating arm	.05
7	3S132645	SCREW, tpg: #4-40 x 7/32 (to secure actuating arm).	.03
8	3S122820	SCREW, tpg: 4-40 x 5/8 (micro sw mtg)	.03
9	3S122820	SCREW, tpg: 4-40 x 5/8 (micro sw mtg)	.03
10	---	SEE Q-6 IN ELECTRICAL PARTS	
11	45A40480B01	ARM, motor actuating	.25
13	3K564805	SCREW, spcl: trans mtg	.03
14	3K564805	SCREW, spcl: trans mtg	.03
15	---	SEE Q-11 IN ELECTRICAL PARTS	
16	14A543810	INSULATOR, trans	.10
19	9K561755	SOCKET, trans	.25
21	22C42038A05	PIN, drive: cartridge tension spring (in some sets)	.05
22	49A41281B01	ROLLER, spring: metal; drilled (cartridge tension spring - in some sets)	.20
	49A43658A01	ROLLER, spring: metal; solid (cartridge tension spring - in some sets)	.15
23	22A43573A01	PIN, transfer: .288-.292 (stereo hd)	.55
25	41P40059A48	SPRING, ROLLER & PIN ASSEM cartridge tension	.35
28	---	SEE E-3 IN ELECTRICAL PARTS	
32	84D43709A03	BOARD, plated: pre-amp; less all components	1.75
37	41A43742A01	SPRING, plunger return	.10
38	47P40059A24	PLUNGER, BRKT & ACTUATOR ASSEM	3.00
39	45B43929A01	CAM & RATCHET ASSEM	1.95
40	43K471633	BEARING, ball: 3/32	.01
41	47A40181B01	PLUNGER, cam tension	.35
42	41A40180B01	SPRING	.05
53	49A43659A03	ROLLER, deck slide: plastic	.25
54	22B43667A03	PIN, spiral: deck slide roller	.05
58	15P40059A28	CAPSTAN HSG ASSEM	3.00
59	22C42038A02	PIN, drive: flywheel ret	.05
60	41B43609A03	SPRING, head bracket mtg	.25
62	3T43787A01	SCREW, spcl: #4-40 x 1/4 (height adjust)	.25
63	43K471633	BEARING, ball: 3/32	.01
64	2S7041	NUT, hex: 2-56 x 3/16 (to secure stereo hd)	.03
65	7B43531A01	BRACKET, tape guide	.20
66	46B40913B01	STOP, tape; nylon: tape guide brkt	.40
67	---	SEE E-4 IN ELECTRICAL PARTS	
71	---	SEE E-1 IN ELECTRICAL PARTS	
72	3S135441	SCREW, mach: 2-56 x 1/4 (to secure stereo hd)	.05
73	41A40180B01	SPRING	.05
75	3T43787A02	SCREW, spcl: #4-40 x 5/8 (azimuth adjust)	.85
76	43K471633	BEARING, ball: 3/32	.01
77	41A43778A01	SPRING, conical: head adjust screw	.10
78	3S6961	SCREW, mach: 4-40 x 3/4 (hd tension adjust)	.03
79	---	SEE E-8 IN ELECTRICAL PARTS	
81	26B43657A01	SHIELD, motor mtg	1.70
85	42B43871A01	BELT, drive	.75
		ACCESSORY SERVICE AIDS AND TOOLS	
	99P43309A01	CARTRIDGE, test tape	17.40
	68P40059A33	DISC, strobe (flywheel)	
	11P40059A53	GLYPTAL (for cementing adjustment screws)	
	11M490487	GREASE, silicon	2.30
	11P40059A55	GREASE, special, light-weight low-temperature type	
	66P40059A32	WRENCH, 1/16" Allen head (for azimuth & height adjustments)	2.50

*DENOTES NEW ITEM APPEARING IN ANY LIST FOR FIRST TIME.

MODEL TM327M

MOTOROLA

service manual



GENERAL INFORMATION

Universal automotive type all-transistor superheterodyne AM radio for standard broadcast reception; operates from 12 volt negative or positive ground system (by simply changing a polarity reversing plug on the radio). This receiver contains a plated chassis board, 6 transistors, 3 diodes and includes an 8 ohm speaker with provisions for an external (rear) speaker.

This radio is of the compact, underdash type. In-dash installations, however, can be made in many cars with the use of trimplate kits AK-223 or KM35T. Special knobs are designed to give all installations a custom look. The tone knob and the dummy knob are reversible. For in-dash installations, the knob is used "backwards" and provides a flush fit. For under-dash installations, the knob is used "face-up" and fills the extra space where the dash would be (see parts location photo).

SERVICE NOTES

1. Make certain the "A" lead is connected properly to power source, i. e., check position of polarity reversing plug, otherwise damage to receiver may result. If a battery eliminator is used as a power source in place of a battery, it must be well filtered and regulated.

2. When replacing a power output transistor, remember to use the transistor specified in the parts list; coat both sides of the transistor insulator with DC-4 grease (Motorola Part No. 11M490487) and securely tighten the transistor mounting screws. When replacing all other transistors, use long-nose pliers as a heat sink, i. e., grasp transistor leads close to transistor base with the pliers to dissipate heat while soldering.

3. The plated chassis used in this receiver has plating on both sides; the exposed side (opposite components) contains the actual circuitry while the plating on the component side contains primarily B- points.

Servicing techniques applicable to this model can be found in the following Motorola publications: "Profitable Transistor Radio Servicing" (Motorola Part Number 68P60011A53) and "A Discussion Of Transistorized Car Radios" (Motorola Part No. 68P64980A51).

4. REAR SPEAKER - The KM8S (6" x 9" - 8 ohm with fader control) rear speaker kit can be used with this radio.

MOTOROLA AUTO RADIO WARRANTY SERVICE STATION PROCEDURE

1. A Motorola Branded Model is one that has the Motorola name and is distributed to dealers through the Motorola Distributor.

2. These models are guaranteed for all parts and labor, including removal and re-installation (R & R), for a period of two years from the date of purchase. The following repairs are not covered under this guarantee: the elimination of motor noise, tire static, electrical interference and faulty installation. Charges for these repairs are to be paid by the customer.

3. Before performing a guarantee repair on a Motorola Branded Auto Radio, you must first receive the Customer's Car Radio Guarantee and Service Booklet. The installation and model information on the booklet must be filled in by the selling dealer at the time of retail sale. The Customer's Car Radio Guarantee and Service Booklet must show that the radio is within the guarantee period to be repaired under the Motorola Auto Radio Guarantee.

4. To obtain your labor allowance for the servicing of the customers in-guarantee set, fill in the Motorola Guarantee Labor Claim, Part No. 68P60016A30. If you perform a R & R service, you are entitled to the R & R allowance. If you only repair the radio without R & R service, you are entitled to the labor allowance. However, if you perform both R & R and the repair, then be sure to indicate both on your claim form for both allowances. After the form has been filled in, mail the pink and green copies to your Motorola Distributor for payment. The yellow copy is to be retained in the Service Station file.

5. Defective parts for guarantee repairs made are to be sent to your Motorola Distributor for free replacement supported with the defective parts return tag, Part Number 54P591808.

6. Only those service stations authorized by their Motorola Distributor can perform repairs within the guarantee period on a no-charge basis to the customer. If you are not an Authorized Motorola Auto Radio Service Station and you are interested in handling this service, please contact your Motorola Distributor for complete details.

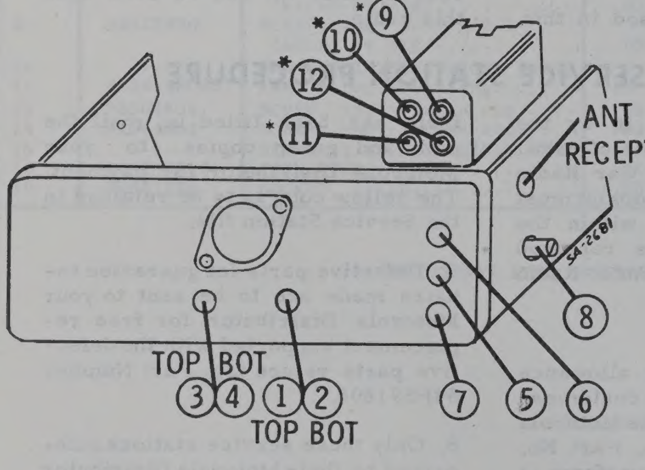
MOTOROLA INC. 9401 WEST GRAND AVENUE, FRANKLIN PARK, ILLINOIS
PART NO. 68P64994A67 4-67 PRICE 20 CENTS COPYRIGHT 1967 BY MOTOROLA INC. - PRINTED IN U.S.A.

ALIGNMENT

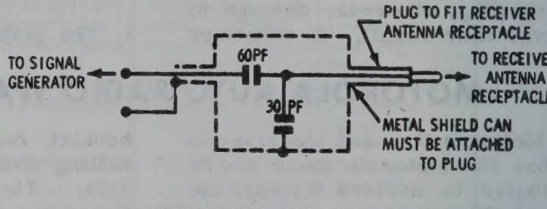
Connect an output meter across the speaker voice coil. Set volume to maximum and tone to treble. Attenuate signal generator output to maintain 1 watt (2.8 volts across an 8 ohm load) on output meter at all times.

STEP	GENERATOR CONNECTION	GENERATOR FREQUENCY (400 cycle 30% mod)	TUNER SET TO	ADJUST	REMARKS
IF ALIGNMENT					
1.	To collector of RF amp thru .1 mf & chassis	262.5Kc	Hi end stop	1, 2, 3 & 4	Adjust for maximum.
RF ALIGNMENT					
2.	Antenna receptacle thru dummy (see Figure)	1610Kc	Hi end stop	5, 6, 7 & 8	Adjust for maximum.
NOTE:	Do not perform Steps 3, 4, 5 and 6 unless the tuner has been tampered with or associated components have been replaced. Remove the escutcheon to expose core screws. Before proceeding with Step 3, back the tuning cores as far as possible out of the coils to eliminate their effect on trimmer adjustments.				
3.	Antenna receptacle thru dummy (see Figure)	1610Kc	Hi end stop	5, 6, 7 & 8	Adjust for maximum.
4.	"	1020Kc	Tuner carriage .298" from hi end stop.	9, 10, 11 & 12	Adjust for maximum.
5.	"	1610Kc	Hi end stop	5, 6, 7 & 8	Adjust for maximum.
6.	Repeat Steps 4 and 5 until no further increase; Step 5 should be last step. Then cement core screws in place.				
ANTENNA TRIMMER					
7.	---	---	Weak station around 1400Kc	8	Adjust for maximum with radio installed in car and antenna fully extended.

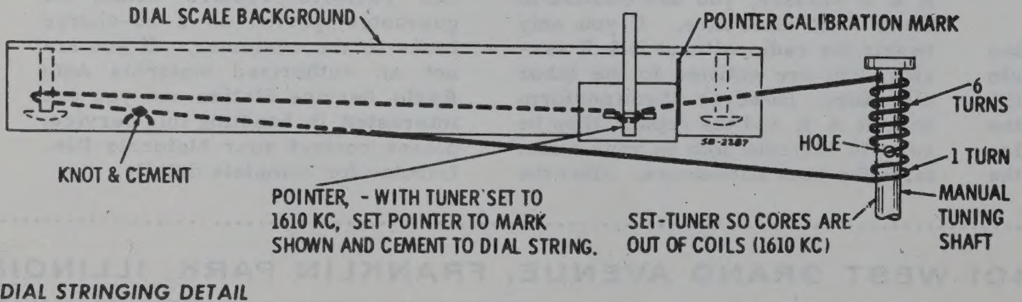
*THESE ADJUSTMENT POINTS ARE ACCESSIBLE FROM FRONT OF RADIO


*
9
*
10
*
12
*
11
ANT
RECEPT
SA-2681
8
TOP
BOT
3
4
1
2
TOP BOT
7
5
6

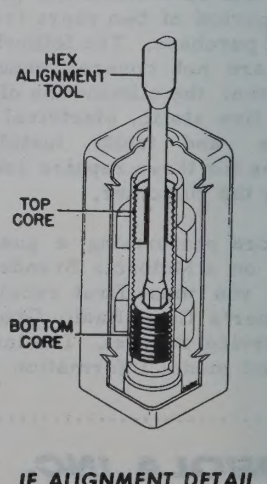
ALIGNMENT LOCATION DETAIL


PLUG TO FIT RECEIVER ANTENNA RECEPTACLE
60PF
TO SIGNAL GENERATOR
TO RECEIVER ANTENNA RECEPTACLE
30PF
METAL SHIELD CAN MUST BE ATTACHED TO PLUG

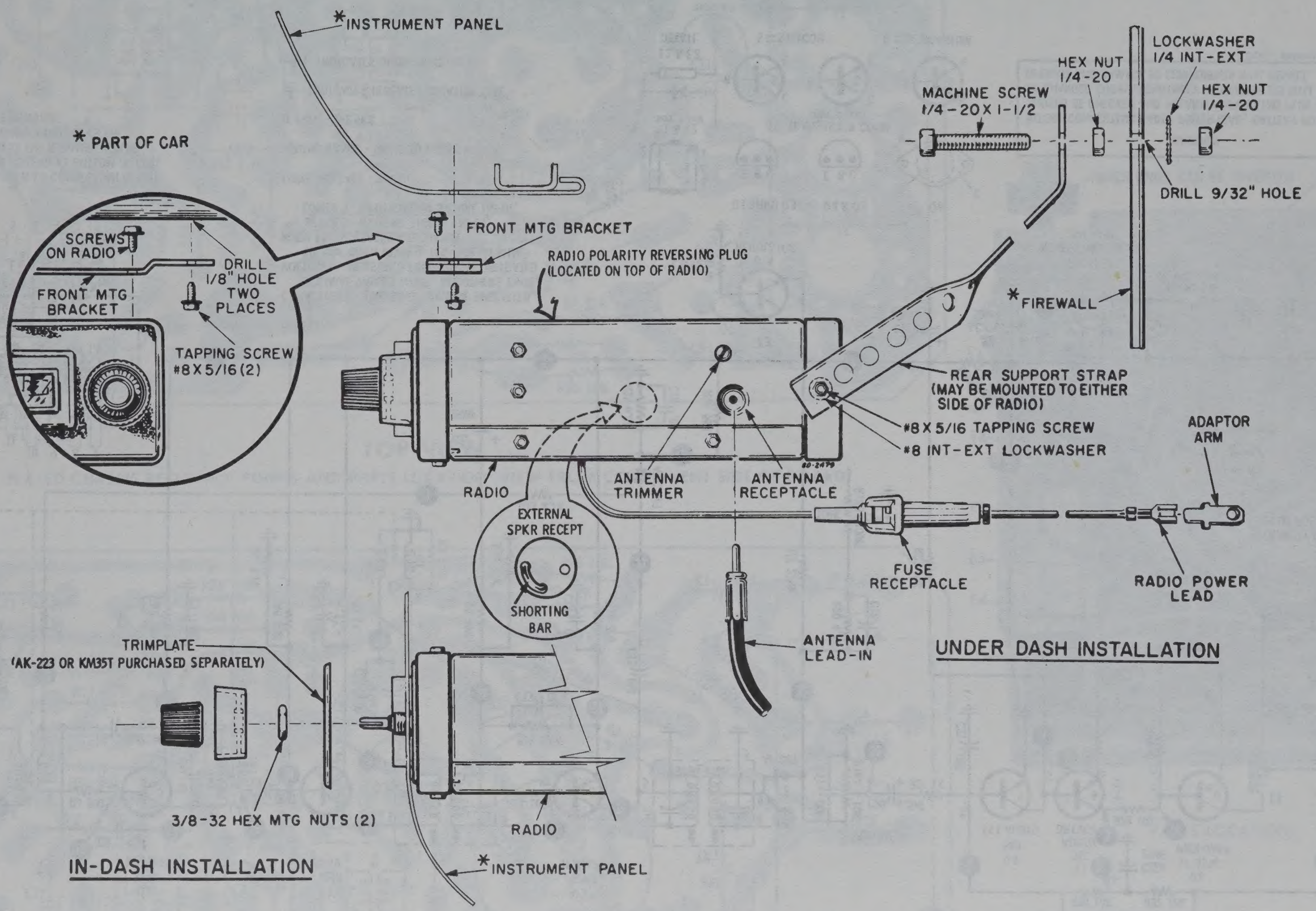
DUMMY ANTENNA DETAIL


DIAL SCALE BACKGROUND
POINTER CALIBRATION MARK
SB-2587
6 TURNS
HOLE
1 TURN
MANUAL TUNING SHAFT
KNOT & CEMENT
POINTER, - WITH TUNER SET TO 1610 KC, SET POINTER TO MARK SHOWN AND CEMENT TO DIAL STRING.
SET-TUNER SO CORES ARE OUT OF COILS (1610 KC)

DIAL STRINGING DETAIL


HEX ALIGNMENT TOOL
TOP CORE
BOTTOM CORE

IF ALIGNMENT DETAIL

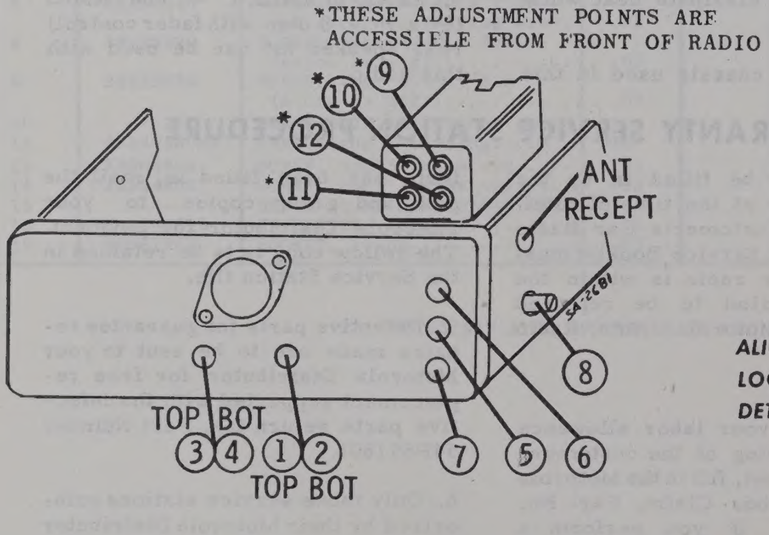

* PART OF CAR
*INSTRUMENT PANEL
SCREWS ON RADIO
DRILL 1/8" HOLE TWO PLACES
FRONT MTG BRACKET
TAPPING SCREW #8 X 5/16 (2)
FRONT MTG BRACKET
RADIO POLARITY REVERSING PLUG (LOCATED ON TOP OF RADIO)
MACHINE SCREW 1/4 - 20 X 1-1/2
HEX NUT 1/4-20
LOCKWASHER 1/4 INT-EXT
HEX NUT 1/4-20
DRILL 9/32" HOLE
*FIREWALL
REAR SUPPORT STRAP (MAY BE MOUNTED TO EITHER SIDE OF RADIO)
#8 X 5/16 TAPPING SCREW
#8 INT-EXT LOCKWASHER
80-2479
RADIO
ANTENNA TRIMMER
ANTENNA RECEPTACLE
ADAPTOR ARM
EXTERNAL SPKR RECEPT
SHORTING BAR
FUSE RECEPTACLE
RADIO POWER LEAD
ANTENNA LEAD-IN
UNDER DASH INSTALLATION
TRIMPLATE (AK-223 OR KM35T PURCHASED SEPARATELY)
3/8-32 HEX MTG NUTS (2)
RADIO
*INSTRUMENT PANEL
IN-DASH INSTALLATION

RADIO INSTALLATION

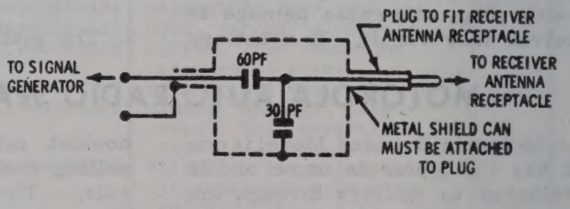
ALIGNMENT

Connect an output meter across the speaker voice coil. Set volume to maximum and tone to treble. Attenuate signal generator output to maintain 1 watt (2.8 volts across an 8 ohm load) on output meter at all times.

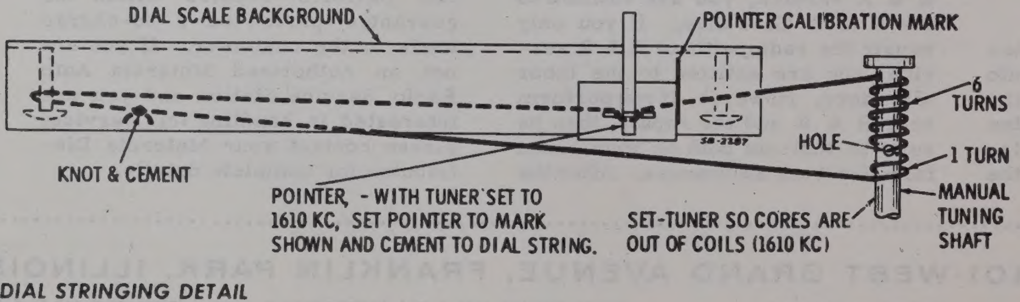
STEP	GENERATOR CONNECTION	GENERATOR FREQUENCY (400 cycle 30% mod)	TUNER SET TO	ADJUST	REMARKS
IF ALIGNMENT					
1.	To collector of RF amp thru .1 mf & chassis	262.5Kc	Hi end stop	1, 2, 3 & 4	Adjust for maximum.
RF ALIGNMENT					
2.	Antenna receptacle thru dummy (see Figure)	1610Kc	Hi end stop	5, 6, 7 & 8	Adjust for maximum.
NOTE:	Do not perform Steps 3, 4, 5 and 6 unless the tuner has been tampered with or associated components have been replaced. Remove the escutcheon to expose core screws. Before proceeding with Step 3, back the tuning cores as far as possible out of the coils to eliminate their effect on trimmer adjustments.				
3.	Antenna receptacle thru dummy (see Figure)	1610Kc	Hi end stop	5, 6, 7 & 8	Adjust for maximum.
4.	"	1020Kc	Tuner carriage .298" from hi end stop.	9, 10, 11 & 12	Adjust for maximum.
5.	"	1610Kc	Hi end stop	5, 6, 7 & 8	Adjust for maximum.
6.	Repeat Steps 4 and 5 until no further increase; Step 5 should be last step. Then cement core screws in place.				
ANTENNA TRIMMER					
7.	---	---	Weak station around 1400Kc	8	Adjust for maximum with radio installed in car and antenna fully extended.


*THESE ADJUSTMENT POINTS ARE ACCESSIBLE FROM FRONT OF RADIO
*9
*10
*12
*11
ANT RECEPT
SA-2681
8
TOP BOT
3 4 1 2
TOP BOT
7
5
6

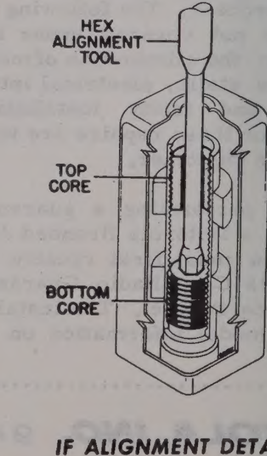
ALIGNMENT LOCATION DETAIL


TO SIGNAL GENERATOR
60PF
30PF
PLUG TO FIT RECEIVER ANTENNA RECEPTACLE
TO RECEIVER ANTENNA RECEPTACLE
METAL SHIELD CAN MUST BE ATTACHED TO PLUG

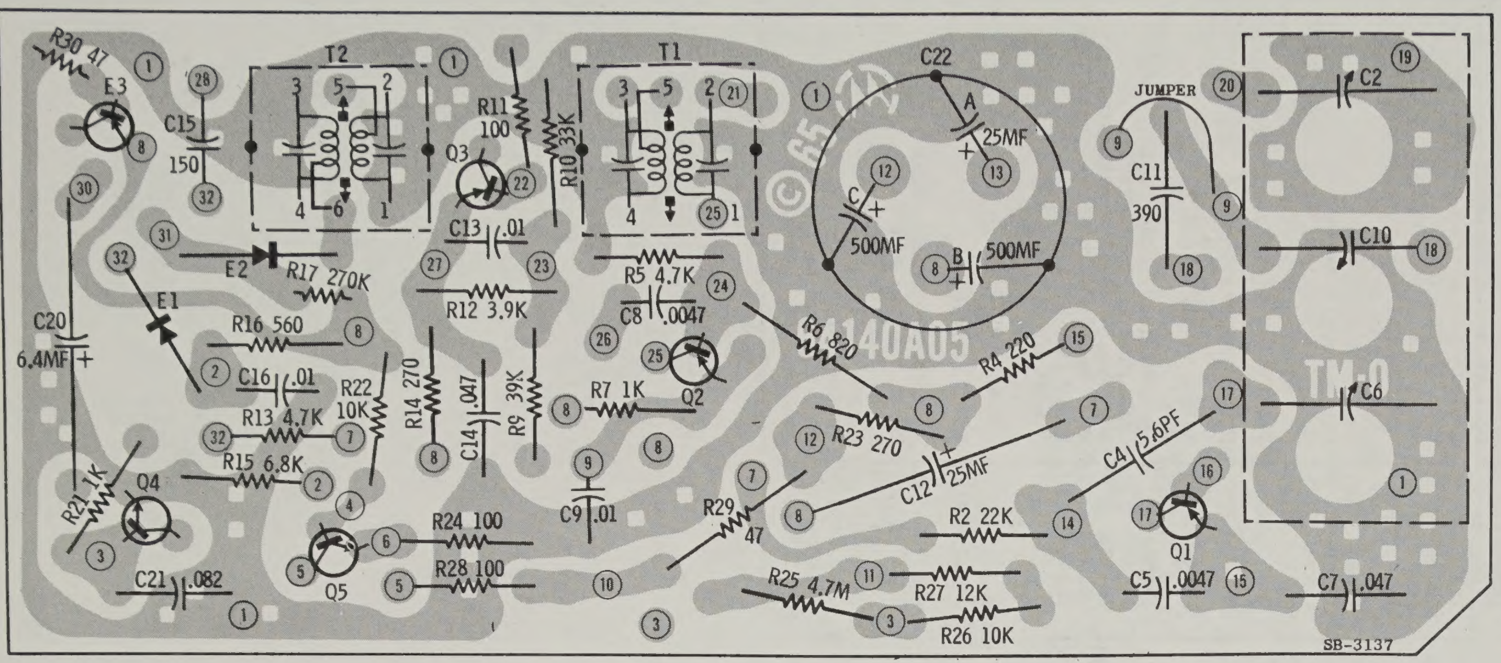
DUMMY ANTENNA DETAIL


DIAL SCALE BACKGROUND
POINTER CALIBRATION MARK
SB-2387
6 TURNS
HOLE
1 TURN
KNOT & CEMENT
POINTER, - WITH TUNER SET TO 1610 KC, SET POINTER TO MARK SHOWN AND CEMENT TO DIAL STRING.
SET-TUNER SO CORES ARE OUT OF COILS (1610 KC)
MANUAL TUNING SHAFT

DIAL STRINGING DETAIL

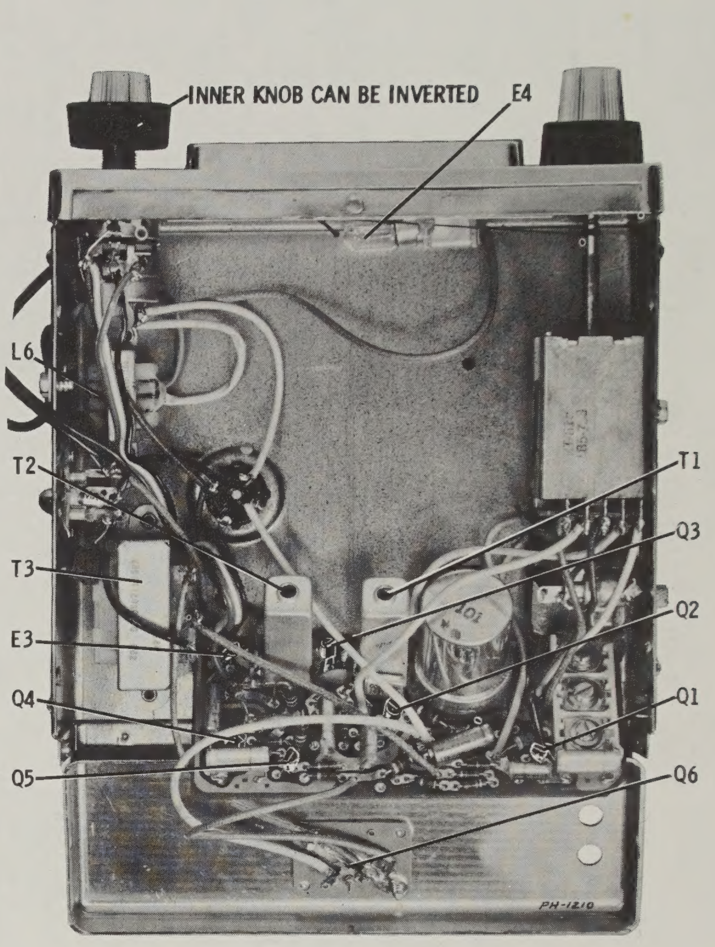

HEX ALIGNMENT TOOL
TOP CORE
BOTTOM CORE

IF ALIGNMENT DETAIL

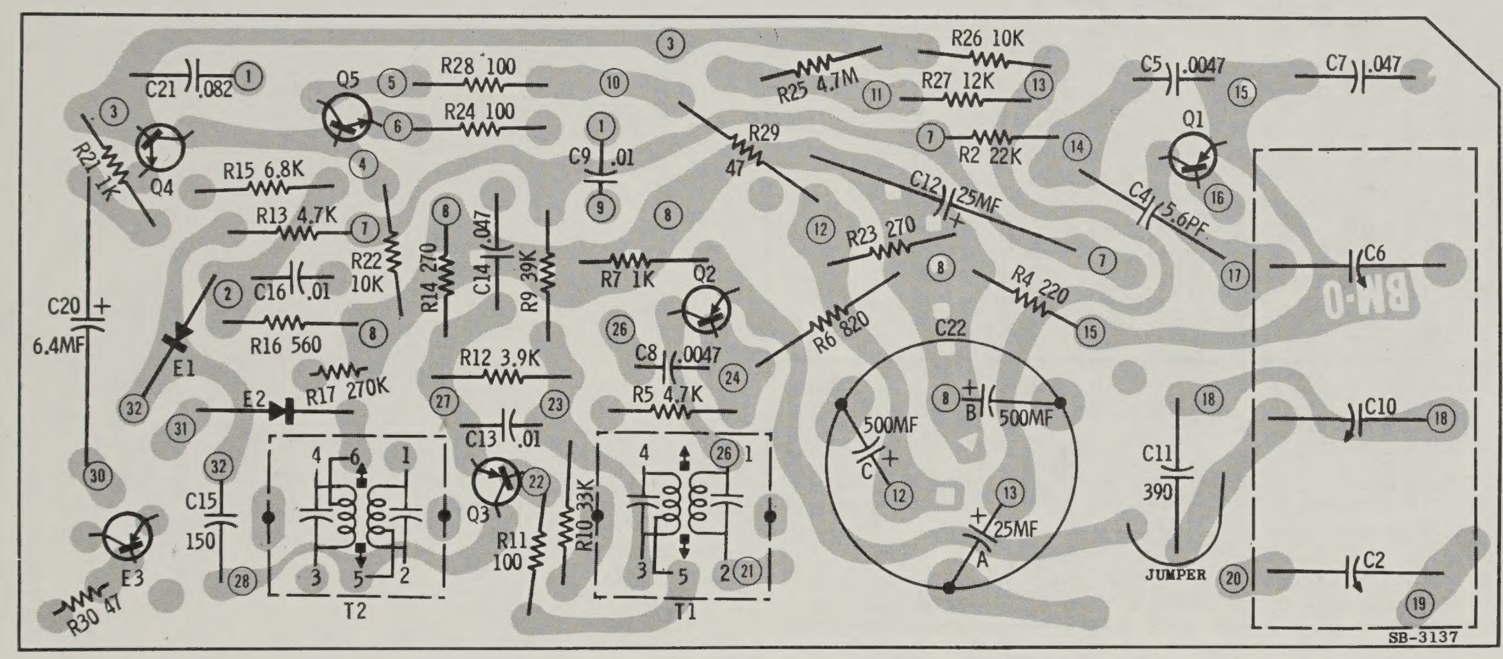

T2
T1
C22
25MF
500MF
JUMPER
C11 390
C2
C10
C6
C15 150
E3
R30 47
E2
E1
R17 270K
R16 560
C20 6.4MF
C16 .01
R22 10K
R13 4.7K
R15 6.8K
R21 1K
Q4
Q5
C21 .082
R11 100
R10 33K
Q3
C13 .01
R12 3.9K
R14 270
C14 .047
R9 39K
R5 4.7K
C8 .0047
Q2
R7 1K
C9 .01
R24 100
R28 100
R6 820
R23 270
C12 25MF
R29 47
R4 220
C4 5.6PF
Q1
R2 22K
R25 4.7M
R27 12K
R26 10K
C5 .0047
C7 .047
140A05
TM-0
SB-3137

TOP VIEW

PLATED CHASSIS REFERENCE POINTS AND PARTS LOCATION (VIEW FROM COMPONENT SIDE OF BOARD)

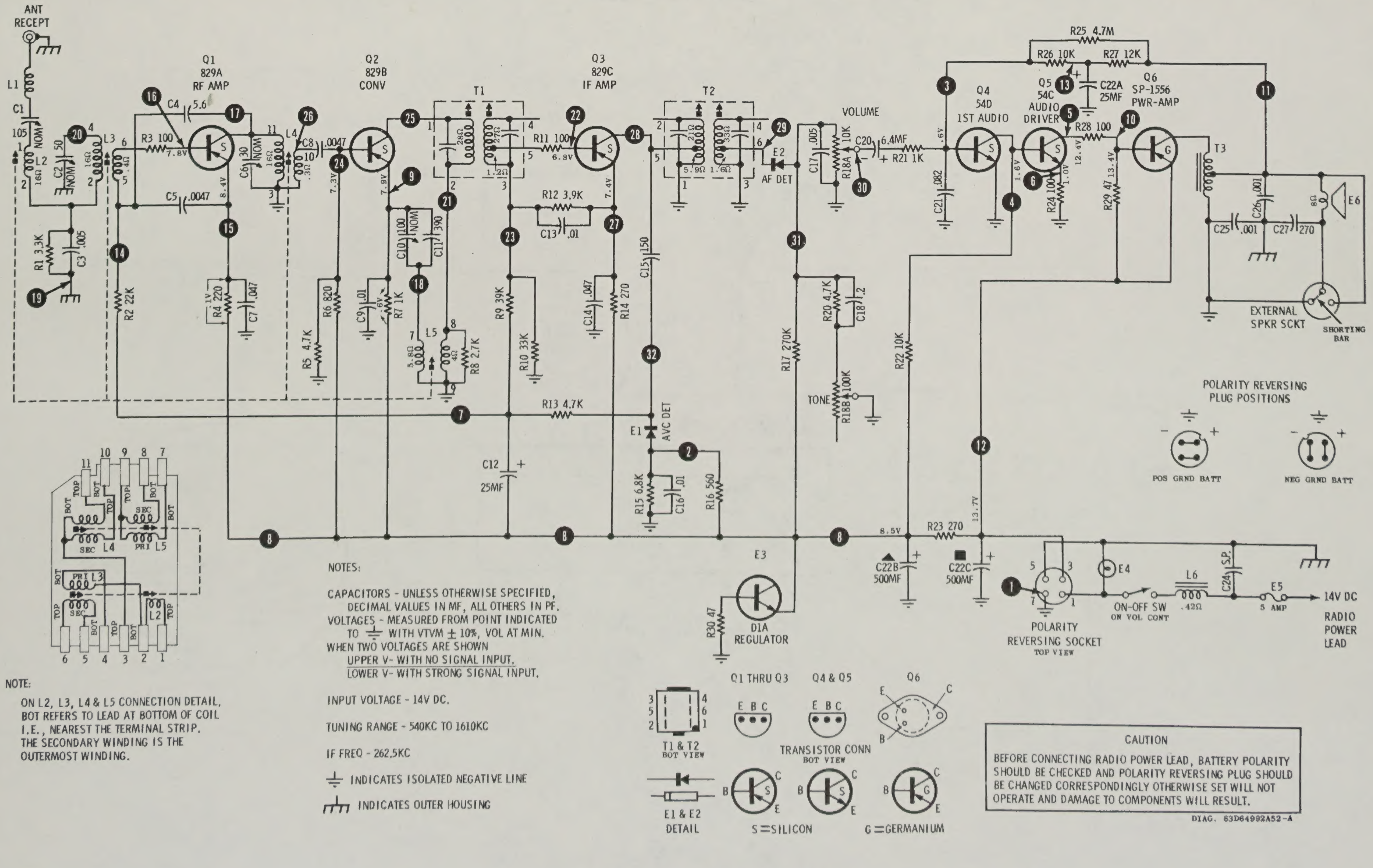

INNER KNOB CAN BE INVERTED
E4
L6
T2
T3
E3
Q4
Q5
T1
Q3
Q2
Q1
Q6
PH-1210

PARTS LOCATION


C21 .082
Q5
R28 100
R24 100
R25 4.7M
R26 10K
R27 12K
C5 .0047
C7 .047
R21 1K
Q4
R15 6.8K
R13 4.7K
R22 10K
R14 270
C14 .047
R9 39K
C9 .01
R29 47
C12 25MF
R23 270
R2 22K
Q1
C4 5.6PF
C6
C20 6.4MF
C16 .01
R16 560
E1
E2
R17 270K
R7 1K
Q2
R12 3.9K
C8 .0047
R5 4.7K
R6 820
R4 220
C22
500MF
25MF
C11 390
JUMPER
C10
C2
C15 150
C13 .01
Q3
R11 100
R10 33K
T2
T1
E3
R30 47
BM-0
SB-3137

BOTTOM VIEW

PLATED CHASSIS REFERENCE POINTS AND PARTS LOCATION (VIEW FROM WIRING SIDE OF BOARD)


ANT RECEPT
L1
C1 105
L2
C2 50
L3
R1 3.3K
C3 .005
Q1 829A RF AMP
C4 5.6
R3 100
7.8V
C5 .0047
8.4V
R4 220
C7 .047
R2 22K
C6 30
L4
C8 .0047
Q2 829B CONV
7.3V
7.9V
R6 820
R5 4.7K
C9 .01
R7 1K
C10 100
C11 390
L5
R8 2.7K
T1
Q3 829C IF AMP
R11 100
6.8V
7.4V
R12 3.9K
C13 .01
R9 39K
R10 33K
C14 .047
R14 270
R13 4.7K
C15 150
T2
E2 AF DET
E1 AVC DET
R15 6.8K
C16 .01
R16 560
C12 25MF
C17 .005
R18A 10K
VOLUME
C20 6.4MF
R21 1K
R17 270K
R20 4.7K
C18 .2
R18B 100K
TONE
R22 10K
Q4 54D 1ST AUDIO
C21 .082
Q5 54C AUDIO DRIVER
R24 100
R25 4.7M
R26 10K
R27 12K
C22A 25MF
R28 100
Q6 SP-1556 PWR-AMP
R29 47
T3
C25 .001
C26 .001
C27 270
E6
EXTERNAL SPKR SCKT
SHORTING BAR
E3
D1A REGULATOR
R30 47
R23 270
C22B 500MF
C22C 500MF
8.5V
13.7V
POLARITY REVERSING SOCKET TOP VIEW
E4
ON-OFF SW ON VOL CONT
L6 .42Ω
C24 S.P.
E5 5 AMP
14V DC RADIO POWER LEAD
POLARITY REVERSING PLUG POSITIONS
POS GRND BATT
NEG GRND BATT
T1 & T2 BOT VIEW
E1 & E2 DETAIL
Q1 THRU Q3
Q4 & Q5
Q6
TRANSISTOR CONN BOT VIEW
S = SILICON
G = GERMANIUM

NOTE:

ON L2, L3, L4 & L5 CONNECTION DETAIL, BOT REFERS TO LEAD AT BOTTOM OF COIL I.E., NEAREST THE TERMINAL STRIP. THE SECONDARY WINDING IS THE OUTERMOST WINDING.

NOTES:

CAPACITORS - UNLESS OTHERWISE SPECIFIED, DECIMAL VALUES IN MF, ALL OTHERS IN PF.

VOLTAGES - MEASURED FROM POINT INDICATED TO ⏚ WITH VTVM ± 10%, VOL AT MIN.

WHEN TWO VOLTAGES ARE SHOWN
UPPER V- WITH NO SIGNAL INPUT.
LOWER V- WITH STRONG SIGNAL INPUT.

INPUT VOLTAGE - 14V DC.

TUNING RANGE - 540KC TO 1610KC

IF FREQ - 262.5KC

⏚ INDICATES ISOLATED NEGATIVE LINE

⊥⊥⊥ INDICATES OUTER HOUSING

CAUTION

BEFORE CONNECTING RADIO POWER LEAD, BATTERY POLARITY SHOULD BE CHECKED AND POLARITY REVERSING PLUG SHOULD BE CHANGED CORRESPONDINGLY OTHERWISE SET WILL NOT OPERATE AND DAMAGE TO COMPONENTS WILL RESULT.

DIAG. 63D64992A52-A

SCHEMATIC DIAGRAM

REPLACEMENT PARTS LIST

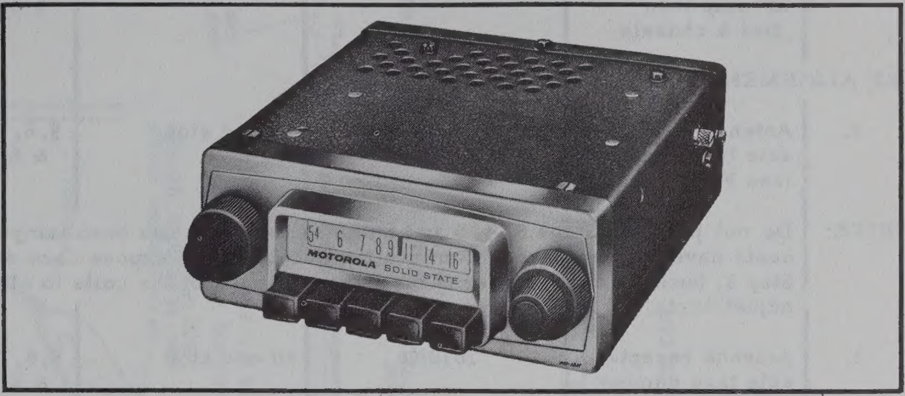
Ref. No.	Part Number	Description
		ELECTRICAL PARTS
CAPACITORS - NOTE:		The capacitors in this list are recommended replacement types for the original equipment; all are ceramic disc type unless otherwise specified.
C-1	20B64616A02	TRIMMER: 40 to 430 pf
C-2	20C64352A02	TRIMMER: 20 to 120 pf; 10 to 80 pf; 65 to 200 pf
C-3	8S131769	.005 mf 20% 200V mylar
C-4	21S120156	5.6 pf 10% 500V
C-5	8S10192A01	.0047 mf 20% 100V mylar
C-6	20C64352A02	TRIMMER: 20 to 120 pf; 10 to 80 pf; 65 to 200 pf
C-7	8S10192A03	.047 mf 20% 100V mylar
C-8	8S10192A01	.0047 mf 20% 100V mylar
C-9	8S10192A02	.01 mf 20% 100V mylar (USE 8C42750A06)
C-10	20C64352A02	TRIMMER: 20 to 120 pf; 10 to 80 pf; 65 to 200 pf
C-11	8S10100A14	390 pf 5% 125V N150 mylar
C-12	23S187A02	25 mf 25V lytic
C-13	21S180C54	.01 mf +80-20% 100V (USE 21S132103)
C-14	8S10192A03	.047 mf 20% 100V mylar
C-15	21S132491	150 pf 10% 500V N750
C-16	2S180C54	.01 mf +80-20% 100V (USE 21S132103)
C-17	21S131999	.005 mf +80-20% 500V
C-18	21S10003A08	.2 mf +80-20% 10V
C-20	23S187A01	6.4 mf 40V lytic
C-21	8S10192A04	.082 mf 20% 100V mylar
C-22	23S184A01	500-500-25 mf/16V lytic
C-24	64A530177	SPARK PLATE
C-25	21S10052A01	1000 pf +10-100% sil mica
C-26	21S10052A01	1000 pf +10-100% sil mica
C-27	8S10100A16	270 pf 5% 125V N150 mylar
MISCELLANEOUS ELECTRICAL PARTS		
E-1	48C134587	DIODE, 1N139
E-2	48C134587	DIODE, 1N139
E-4	65S538410	BULB, dial: .11A-14.4V
E-5	65S122345	FUSE, 5 amp
E-6	50C64119A01	SPEAKER, 5 PM: 8Ω VC
COILS & CHOKES		
L-1	24C64003B01	CHOKE, ant
L-6	25C64172A01	CHOKE, filter
CONTROL		
R-18	18C64734A02	CONTROL, vol-tone & sw
TRANSFORMERS		
T-1	24C64327A03	1ST IF
T-2	24C64327A02	2ND IF
T-3	25D64129A05	OUTPUT

Ref. No.	Part Number	Description
TRANSISTORS		
Q-1	48S134830	829A
Q-2	48S134831	829B
Q-3	48S134832	829C
Q-4	48S134811	54D
Q-5	48S134810	54C
Q-6	48S134759	SP1556-2
E-3	48S134912	DIA
		MECHANICAL PARTS
	84C64140A05	BOARD, plated chassis
	7K544857	BRACKET, radio mtg
	15C64124A01	COVER, back
	15D64114A01	COVER, bottom
	13D64367A04	ESCUTCHEON, dial
	14A543810	INSULATOR, trans
	36K544813	KNOB, pendant
	36K544812	KNOB, tone
	36K544598	KNOB, vol & sw
	29K534326	LUG, term: fuse recept
	13K64355A03	MASK, dial
	2S1376	NUT, hex: 3/8-32 (radio mtg)
	2S7051	NUT, pal: cont mtg
	2S10101A29	NUT, speed: dial scale
	2S10101A10	NUT, speed: spkr mtg
	28A542751	PLUG, polarity revr
	28A533474	PLUG, shorting: spkr
	1V64954A07	POINTER & SLIDER ASSEM
	9A533475	RECEPTACLE, 3-pin: ext spkr
	9A531066	RECEPTACLE, ant
	1V64964A32	RECEPTACLE, fuse: compl
	9K543850	RECEPTACLE, polarity revr (USE 9B542750)
	34B64358A01	SCALE, dial
	3K560695	SCREW, spcl: trans mtg
	9K544772	SOCKET, dial lite (USE 9K511643)
	9B542339	SOCKET, trans
	42A544845	STRAP, radio mtg
		INSTALLATION PARTS
	1V64952A02	RADIO INSTALLATION KIT
	45K538873	ARM, adaptor: fuse recept
	8A4491	CAPACITOR, noise suppr
	2S1376	NUT, hex: 3/8-32 (radio mtg)
	2S2878	NUT, hex: 1/4-20 (brkt mtg)
	3S9694	SCREW, mach: 1/4-20 x 1-1/2 (brkt mtg)
		TUNER PARTS
	*77D40898A06	TUNER, MT615
	1V43800A12	COILS & MTG PLATE ASSEM
	76C40706A14	CORE, tuning: ant & RF
	76C40647A08	CORE, tuning: osc
	47C40648A08	SHAFT, tuning
	41B40650A01	SPRING, shaft ret
	41A40895B01	SPRING, tension
	4K721821	WASHER, "C": shaft ret

*DENOTES NEW ITEM APPEARING IN ANY LIST FOR FIRST TIME.

MODEL TM527A

MOTOROLA service manual



GENERAL INFORMATION

Universal automotive type all-transistor superheterodyne AM radio for standard broadcast reception; operates from 12 volt negative or positive ground system (by simply re-positioning a polarity reversing plug on the radio). This receiver contains a plated chassis board, 6 transistors, 3 diodes and an external 8 ohm speaker.

This radio is of the compact under-dash type. In-dash installations, however, can be made in many cars with the use of trimplate kits AK-223 or KM35T. Special knobs are designed to give all installations a custom look. The tone knob and the dummy knob are reversible. For in-dash installations, the knob is used "backwards" and provides a flush fit. For under-dash installations, the knob is used "face-up" and fills the extra space where the dash would be.

SERVICE NOTES

1. Make certain the "A" lead is connected properly to power source, i. e., check position of polarity reversing plug, otherwise damage to receiver may result. If a battery eliminator is used as a power source in place of a battery, it must be well filtered and regulated.

2. When replacing a power output transistor, remember to use the transistor specified in the parts list; coat both sides of the transistor insulator with DC-4 grease (Motorola Part No. 11M490487) and securely tighten the transistor mounting screws. When replacing all other transistors, use long-nose pliers as a heat sink, i. e., grasp transistor leads close to transistor base with the pliers to dissipate heat while soldering.

3. The plated chassis used in this receiver has plating on both sides; the exposed side (opposite components) contains the actual circuitry while the plating on the component side contains primarily B- points.

Servicing techniques applicable to this model can be found in the following Motorola publications: "Profitable Transistor Radio Servicing" (Motorola Part Number 68P60011A53) and "A Discussion Of Transistorized Car Radios" (Motorola Part No. 68P64980A51).

4. REAR SPEAKER - The KM8S (6" x 9" - 8 ohm with fader control) rear speaker kit can be used with this radio.

TO SET PUSHBUTTONS

Unlock pushbutton by pulling it out about 1/2" forward of its normal position. Tune in station and lock the pushbutton to the station by pushing it in firmly.

MOTOROLA AUTO RADIO WARRANTY SERVICE STATION PROCEDURE

1. A Motorola Branded Model is one that has the Motorola name and is distributed to dealers through the Motorola Distributor.

2. These models are guaranteed for all parts and labor, including removal and re-installation (R & R), for a period of two years from the date of purchase. The following repairs are not covered under this guarantee: the elimination of motor noise, tire static, electrical interference and faulty installation. Charges for these repairs are to be paid by the customer.

3. Before performing a guarantee repair on a Motorola Branded Auto Radio, you must first receive the Customer's Car Radio Guarantee and Service Booklet. The installation and model information on the booklet must be filled in by the selling dealer at the time of retail sale. The Customer's Car Radio Guarantee and Service Booklet must show that the radio is within the guarantee period to be repaired under the Motorola Auto Radio Guarantee.

4. To obtain your labor allowance for the servicing of the customers in-guarantee set, fill in the Motorola Guarantee Labor Claim, Part No. 68P60016A30. If you perform a R & R service, you are entitled to the R & R allowance. If you only repair the radio without R & R service, you are entitled to the labor allowance. However, if you perform both R & R and the repair, then be sure to indicate both on your claim form for both allowances. After the form has been filled in, mail the pink and green copies to your Motorola Distributor for payment. The yellow copy is to be retained in the Service Station file.

5. Defective parts for guarantee repairs made are to be sent to your Motorola Distributor for free replacement supported with the defective parts return tag, Part Number 54P591808.

6. Only those service stations authorized by their Motorola Distributor can perform repairs within the guarantee period on a no-charge basis to the customer. If you are not an Authorized Motorola Auto Radio Service Station and you are interested in handling this service, please contact your Motorola Distributor for complete details.

MOTOROLA INC. 9401 WEST GRAND AVENUE, FRANKLIN PARK, ILLINOIS

PART NO. 68P64994A69 4-67 PRICE 20 CENTS

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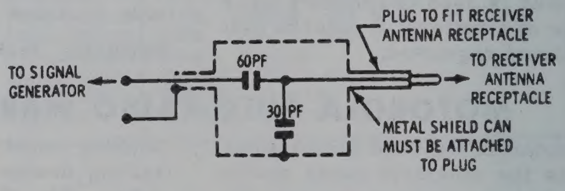
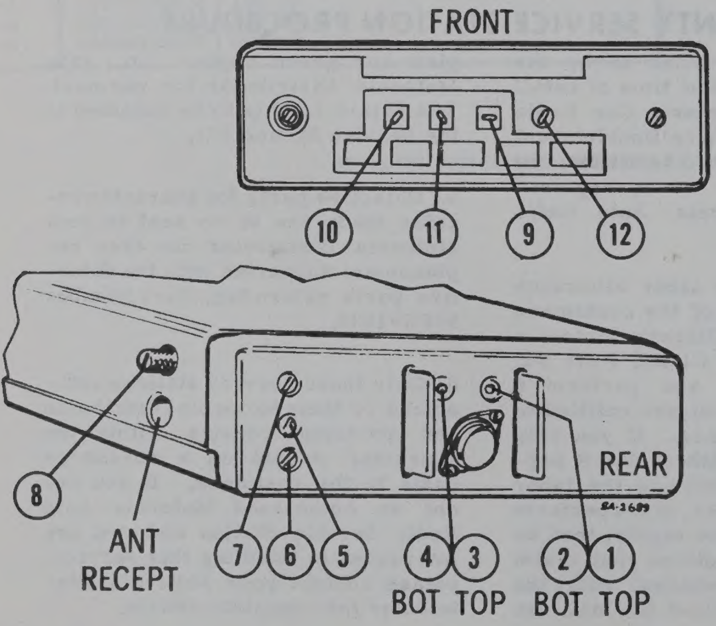
ALIGNMENT

Connect an output meter across the speaker voice coil. Set volume to maximum and tone to treble. Attenuate signal generator output to maintain 1 watt (2.83 volts across an 8 ohm load) on output meter at all times.

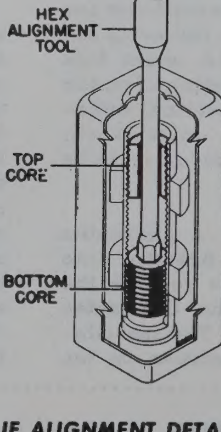
STEP	GENERATOR CONNECTION	GENERATOR FREQUENCY (400 cycle 30% mod)	TUNER SET TO	ADJUST	REMARKS
IF ALIGNMENT					
1.	To collector of RF amp thru .1mf & chassis	262.5Kc	Hi end stop	1, 2, 3 & 4	Adjust for maximum.
RF ALIGNMENT					
2.	Antenna receptacle thru dummy (see Figure)	1610Kc	Hi end stop	5, 6, 7 & 8	Adjust for maximum.
NOTE:	Do not perform Steps 3, 4, 5 and 6 unless the tuner has been tampered with or associated components have been replaced. Remove the escutcheon to expose core screws. Before proceeding with Step 3, back the tuning cores as far as possible out of the coils to eliminate their effect on trimmer adjustments.				
3.	Antenna receptacle thru dummy (see Figure)	1610Kc	Hi end stop	5, 6, 7 & 8	Adjust for maximum.
4.	"	1200Kc	Tuner carriage .285" from hi end stop	9, 10, 11 & 12	Adjust for maximum.
5.	"	1610Kc	Hi end stop	5, 6, 7 & 8	Adjust for maximum.
6.	Repeat Steps 4 and 5 until no further increase; Step 5 should be last step. Then, cement core screws in place.				
ANTENNA TRIMMER					
7.	---	---	Weak station around 1400Kc	8	Adjust for maximum with radio installed in car and antenna fully extended.


PLUG TO FIT RECEIVER ANTENNA RECEPTACLE
TO SIGNAL GENERATOR
60PF
TO RECEIVER ANTENNA RECEPTACLE
30PF
METAL SHIELD CAN MUST BE ATTACHED TO PLUG

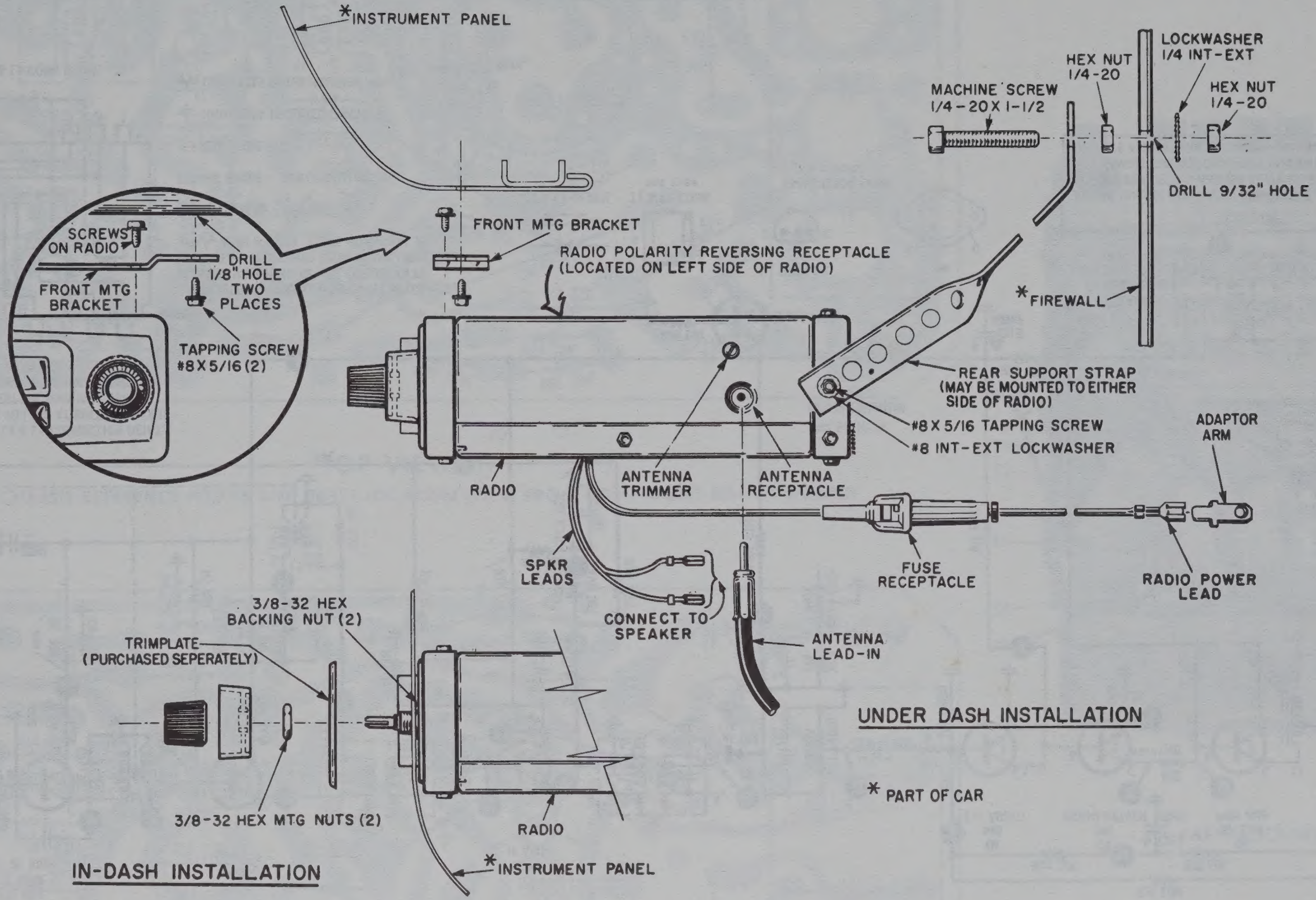
DUMMY ANTENNA DETAIL


FRONT
10
11
9
12
8
ANT RECEPT
7
6
5
4
3
BOT TOP
2
1
BOT TOP
REAR
EA-1689

ALIGNMENT LOCATION DETAIL


HEX ALIGNMENT TOOL
TOP CORE
BOTTOM CORE

IF ALIGNMENT DETAIL


*INSTRUMENT PANEL
SCREWS ON RADIO
DRILL 1/8" HOLE TWO PLACES
FRONT MTG BRACKET
TAPPING SCREW #8 X 5/16 (2)
FRONT MTG BRACKET
RADIO POLARITY REVERSING RECEPTACLE (LOCATED ON LEFT SIDE OF RADIO)
MACHINE SCREW 1/4-20 X 1-1/2
HEX NUT 1/4-20
LOCKWASHER 1/4 INT-EXT
HEX NUT 1/4-20
DRILL 9/32" HOLE
*FIREWALL
REAR SUPPORT STRAP (MAY BE MOUNTED TO EITHER SIDE OF RADIO)
#8 X 5/16 TAPPING SCREW
#8 INT-EXT LOCKWASHER
ADAPTOR ARM
RADIO
ANTENNA TRIMMER
ANTENNA RECEPTACLE
FUSE RECEPTACLE
RADIO POWER LEAD
SPKR LEADS
CONNECT TO SPEAKER
ANTENNA LEAD-IN
UNDER DASH INSTALLATION
* PART OF CAR
3/8-32 HEX BACKING NUT (2)
TRIMPLATE (PURCHASED SEPERATELY)
3/8-32 HEX MTG NUTS (2)
RADIO
*INSTRUMENT PANEL
IN-DASH INSTALLATION

RADIO INSTALLATION

ALIGNMENT

Connect an output meter across the speaker voice coil. Set volume to maximum and tone to treble. Attenuate signal generator output to maintain 1 watt (2.83 volts across an 8 ohm load) on output meter at all times.

STEP	GENERATOR CONNECTION	GENERATOR FREQUENCY (400 cycle 30% mod)	TUNER SET TO	ADJUST	REMARKS
IF ALIGNMENT					
1.	To collector of RF amp thru .1mf & chassis	262.5Kc	Hi end stop	1, 2, 3 & 4	Adjust for maximum.
RF ALIGNMENT					
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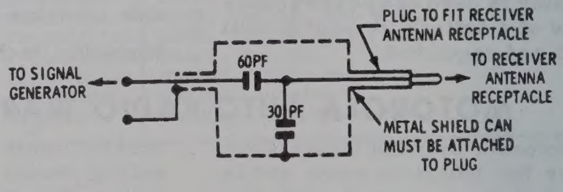
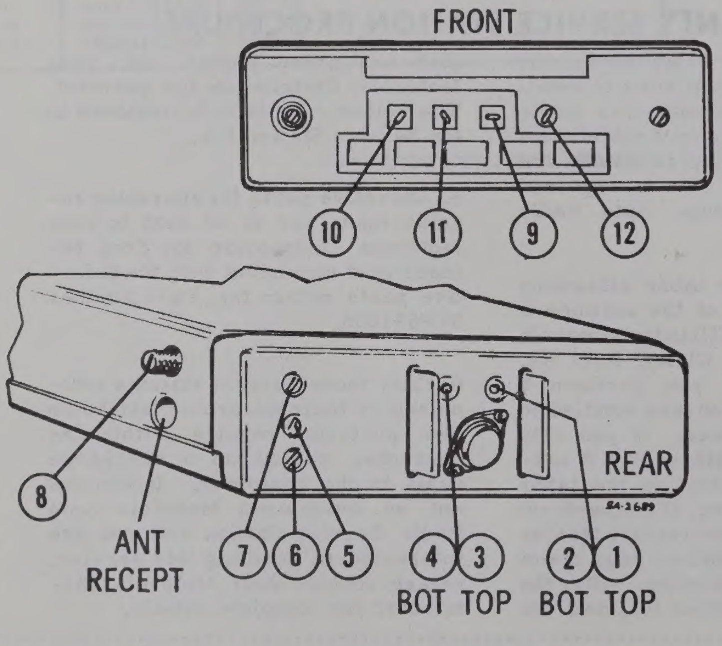
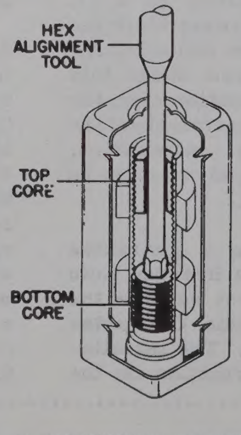

PLUG TO FIT RECEIVER ANTENNA RECEPTACLE
60PF
TO RECEIVER ANTENNA RECEPTACLE
TO SIGNAL GENERATOR
30 PF
METAL SHIELD CAN MUST BE ATTACHED TO PLUG

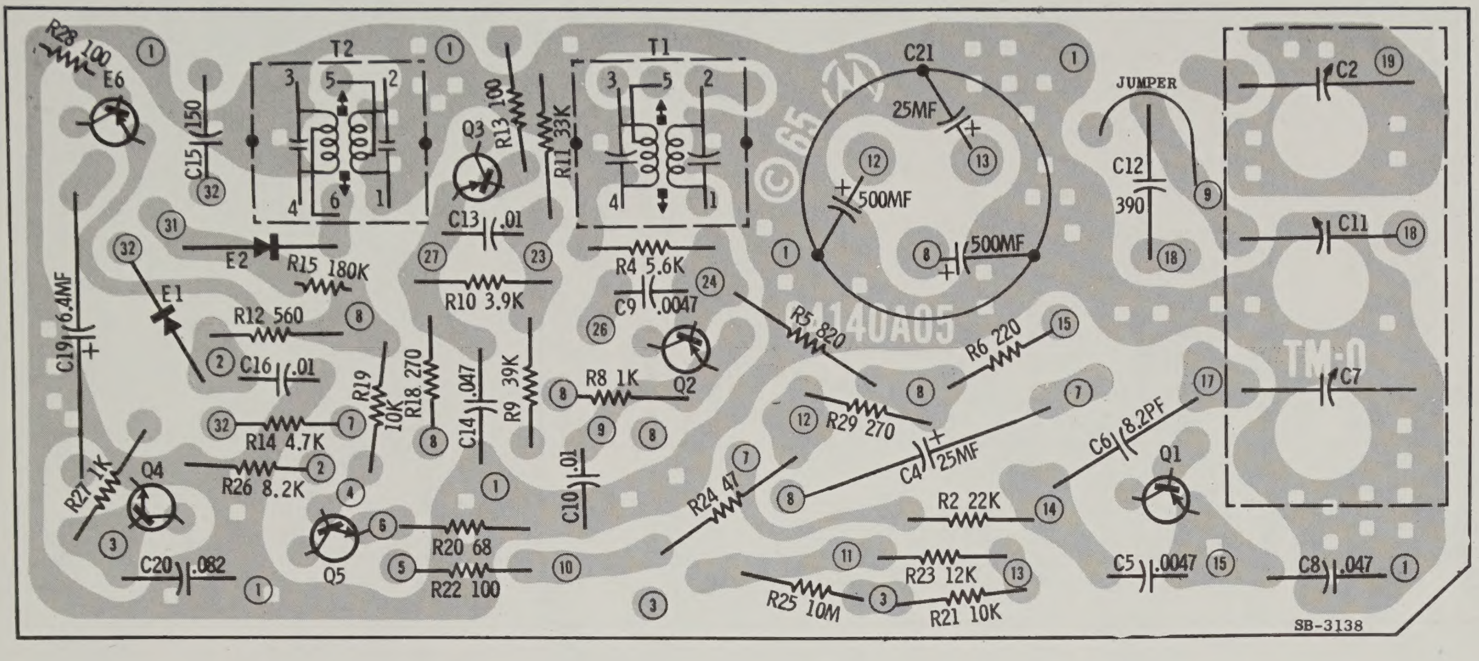
DUMMY ANTENNA DETAIL


FRONT
10
11
9
12
8
ANT RECEPT
7
6
5
4
3
2
1
BOT TOP
BOT TOP
REAR
SA-1689

ALIGNMENT LOCATION DETAIL

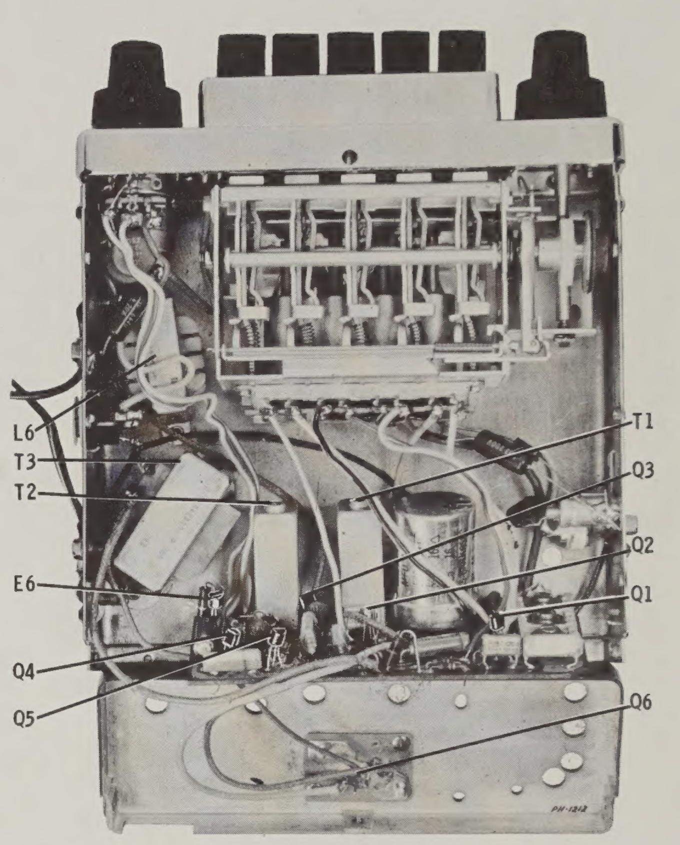

HEX ALIGNMENT TOOL
TOP CORE
BOTTOM CORE

IF ALIGNMENT DETAIL

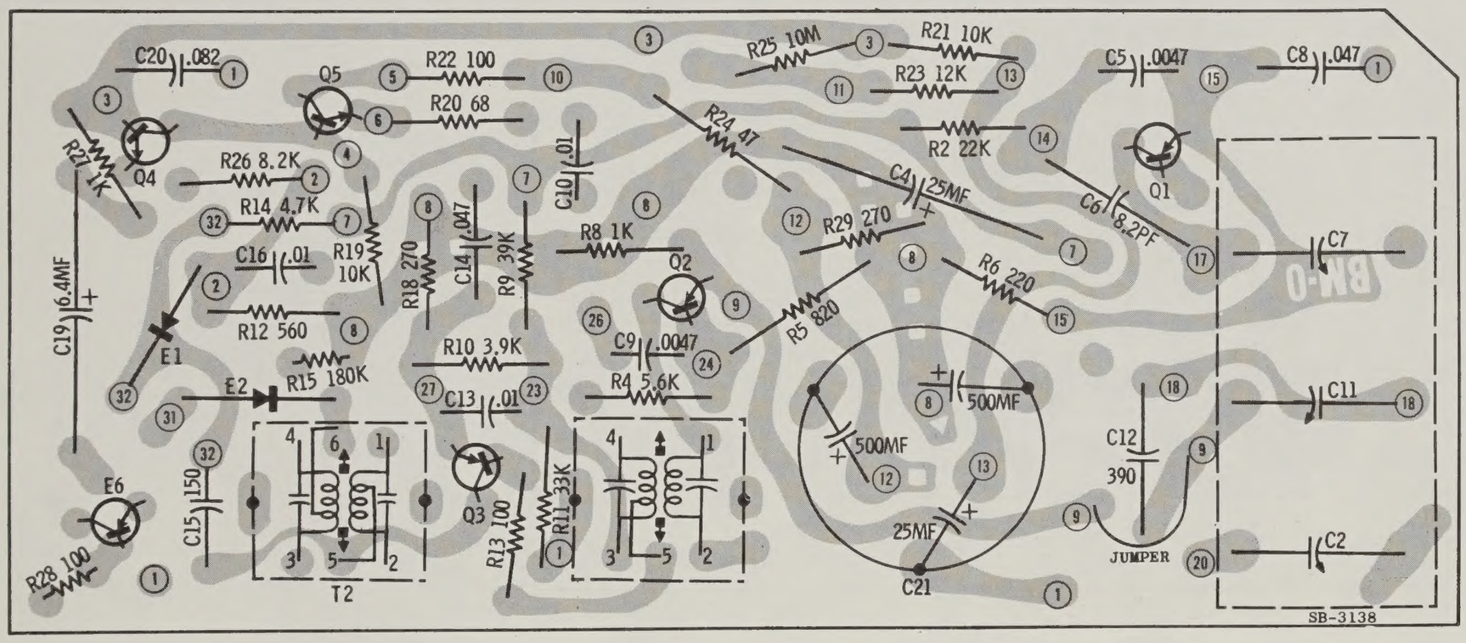

R28 100
E6
C15 150
T2
Q3
R13 100
R11 33K
T1
C21
25MF
500MF
JUMPER
C12
390
C2
C11
C7
TM-0
C19 6.4MF
E1
E2
R15 180K
R12 560
C16 .01
R14 4.7K
R26 8.2K
R27 1K
Q4
C20 .082
Q5
R19 10K
R18 270
C14 .047
R9 39K
R10 3.9K
C13 .01
R4 5.6K
C9 .0047
Q2
R8 1K
C10 .01
R20 68
R22 100
R5 820
R29 270
R6 220
R24 47
C4 25MF
R2 22K
C6 8.2PF
Q1
R25 10M
R23 12K
R21 10K
C5 .0047
C8 .047
4140A05
SB-3138

TOP VIEW

PLATED CHASSIS REFERENCE POINTS AND PARTS LOCATION (VIEW FROM COMPONENT SIDE OF BOARD)


L6
T3
T2
E6
Q4
Q5
T1
Q3
Q2
Q1
Q6

PARTS LOCATION


C20 .082
Q5
R22 100
R20 68
R25 10M
R21 10K
R23 12K
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C5 .0047
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Q4
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R26 8.2K
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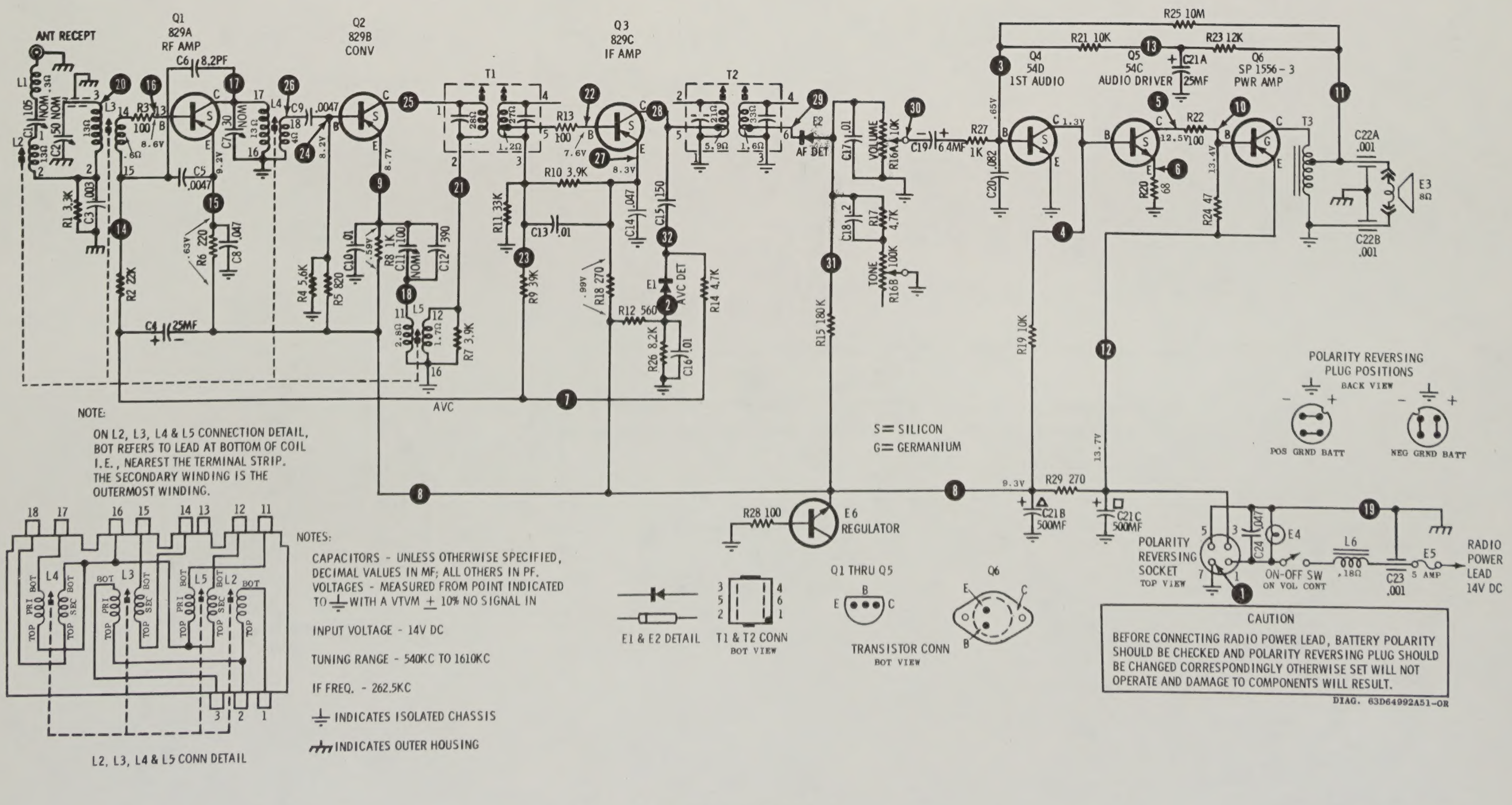
R19 10K
R18 270
C14 .047
R9 39K
C10 .01
R8 1K
R24 47
C4 25MF
R29 270
C6 8.2PF
Q1
C7
BM-0
C16 .01
C19 6.4MF
E1
R12 560
Q2
R5 820
R6 220
R10 3.9K
C9 .0047
500MF
E2
R15 180K
C13 .01
R4 5.6K
C11
C12
390
C15 150
Q3
R11 33K
25MF
C21
JUMPER
C2
E6
R28 100
T2
R13 100
SB-3138

BOTTOM VIEW

PLATED CHASSIS REFERENCE POINTS AND PARTS LOCATION (VIEW FROM WIRING SIDE OF BOARD)


ANT RECEPT
Q1
829A
RF AMP
Q2
829B
CONV
Q3
829C
IF AMP
Q4
54D
1ST AUDIO
Q5
54C
AUDIO DRIVER
Q6
SP 1556-3
PWR AMP
R25 10M
R21 10K
R23 12K
C21A 25MF
R22 100
T1
T2
T3
E2
AF DET
E1
AVC DET
VOLUME
R16A 10K
TONE
R16B 100K
R17 4.7K
C17 .01
C18 .2
C19 6.4MF
R27 1K
C20 .082
R15 180K
R19 10K
R24 47
R20 68
C22A .001
C22B .001
E3 8Ω
R29 270
C21B 500MF
C21C 500MF
R28 100
E6
REGULATOR
AVC
S = SILICON
G = GERMANIUM
POLARITY REVERSING PLUG POSITIONS
BACK VIEW
POS GRND BATT
NEG GRND BATT
POLARITY REVERSING SOCKET
TOP VIEW
C24 .047
E4
ON-OFF SW
ON VOL CONT
L6 .18Ω
C23 .001
E5 5 AMP
RADIO POWER LEAD 14V DC
E1 & E2 DETAIL
T1 & T2 CONN
BOT VIEW
Q1 THRU Q5
TRANSISTOR CONN
BOT VIEW
Q6
L2, L3, L4 & L5 CONN DETAIL
DIAG. 63D64992A51-OR

NOTE:

ON L2, L3, L4 & L5 CONNECTION DETAIL, BOT REFERS TO LEAD AT BOTTOM OF COIL I.E., NEAREST THE TERMINAL STRIP. THE SECONDARY WINDING IS THE OUTERMOST WINDING.

NOTES:

CAPACITORS - UNLESS OTHERWISE SPECIFIED, DECIMAL VALUES IN MF; ALL OTHERS IN PF.

VOLTAGES - MEASURED FROM POINT INDICATED TO ⏚ WITH A VTVM ± 10% NO SIGNAL IN

INPUT VOLTAGE - 14V DC

TUNING RANGE - 540KC TO 1610KC

IF FREQ. - 262.5KC

⏚ INDICATES ISOLATED CHASSIS

⫽ INDICATES OUTER HOUSING

CAUTION

BEFORE CONNECTING RADIO POWER LEAD, BATTERY POLARITY SHOULD BE CHECKED AND POLARITY REVERSING PLUG SHOULD BE CHANGED CORRESPONDINGLY OTHERWISE SET WILL NOT OPERATE AND DAMAGE TO COMPONENTS WILL RESULT.

SCHEMATIC DIAGRAM

REPLACEMENT PARTS LIST

Ref. No.	Part Number	Description
		ELECTRICAL PARTS
CAPACITORS - NOTE: The capacitors in this list are recommended replacement types for the original equipment; all are ceramic disc type unless otherwise specified.		
C-1	20B64616A02	TRIMMER: 40 to 430 pf
C-2	20C64352A02	TRIMMER: 20 to 120 pf; 10 to 80 pf; 65 to 200 pf
C-3	8S10064A34	.003 mf 10% 200V mylar
C-4	23S187A02	25 mf 25V lytic
C-5	8S10192A01	.0047 mf 20% 100V mylar
C-6	21S120159	8.2 pf 10% 500V FC
C-7	20C64352A02	TRIMMER: 20 to 120 pf; 10 to 80 pf; 65 to 200 pf
C-8	8S10192A03	.047 mf 20% 100V mylar
C-9	8S10192A01	.0047 mf 20% 100V mylar
C-10	8S10192A02	.01 mf 20% 100V mylar
C-11	20C64352A02	TRIMMER: 20 to 120 pf; 10 to 80 pf; 65 to 200 pf
C-12	8S10100A14	390 pf 5% 125V N150 mylar
C-13	21S132492	.01 mf +80-20% 100V (USE 21K132103)
C-14	8S10192A03	.047 mf 20% 100V mylar
C-15	21S132491	150 pf 10% 500V N750
C-16	21S132492	.01 mf +80-20% 100V (USE 21K132103)
C-17	21S131994	.01 mf +80-20% 500V
C-18	21S10003A08	.2 mf +80-20% 10V
C-19	23S187A01	6.4 mf 40V lytic
C-20	8S10192A04	.082 mf 20% 100V mylar
C-21	23S184A01	500-500-25 mf/16V lytic
C-22A	21A560232	FEED-THRU
C-22B	21A560232	FEED-THRU
C-23	21A560232	FEED-THRU
C-24	8S10064F14	.047 mf 20% 50V mylar
MISCELLANEOUS ELECTRICAL PARTS		
E-1	48C134587	DIODE, 1N139
E-2	48C134587	DIODE, 1N139
E-3	50C64137A01	SPEAKER, 5 x 7 PM: 8Ω VC
E-4	65S538410	BULB, dial:.11A-14.4V
E-5	65S122345	FUSE, 5 amp
COILS & CHOKES		
L-1	24C64003B01	CHOKE, antenna
L-2,L-3 L-4,L-5	---	SEE TUNER PARTS
L-6	25C64172A05	CHOKE, filter (USE 25C64172A08)
RESISTORS & CONTROLS		
R-16	18C64734A03	CONTROL, vol-tone-sw
TRANSFORMERS		
T-1	24C64327A03	1ST IF
T-2	24C64327A02	2ND IF
T-3	25D64129A01	OUTPUT
TRANSISTORS		
Q-1	48S134830	829A
Q-2	48S134831	829B
Q-3	48S134832	829C
Q-4	48S134811	54D
Q-5	48S134810	54C
Q-6	48S134760	SP1556-3 (USE 48S134759)
E-6	48S134912	D1A
		MECHANICAL PARTS
	84C64140A05	BOARD, plated chassis
	7B543897	BRACKET, dial bkgnd
	7K544857	BRACKET, radio mtg
	1V64952A38	COVER, back: incl socket
	15K544856	COVER, bottom (USE 15K543815)
	13C543880	ESCUTCHEON, dial
	14A543810	INSULATOR, trans
	36K543878	KNOB, pendant
	36B543877	KNOB, tone
	36B543876	KNOB, vol-tone-sw
	29K534326	LUG, term: fuse recept
	29S10134A02	LUG, term: spkr leads
	13B544013	MASK, dial
	2S1376	NUT, hex: 3/8-32 (radio mtg)
	21S10101A29	NUT, push-on: dial & mask ret
	2S7051	NUT, speed: 3/8-32 (cont mtg)
	28A542751	PLUG, polarity revr
	9A531066	RECEPTACLE, ant
	1V64964A32	RECEPTACLE, fuse: compl
	9K543850	RECEPTACLE, polarity revr (USE 9B542750)
	34B64285A01	SCALE, dial
	3K560695	SCREW, spcl: trans mtg
	9A543879	SOCKET, dial lite
	9B542339	SOCKET, trans
	*41A64185B01	SPRING, gnd
	42K544845	STRAP, radio mtg
	39K502418	WIPER, gnd: bott cover
		INSTALLATION PARTS
	1V64951A58	RADIO INSTALLATION KIT
	45K538873	ARM, adaptor: fuse recept
	8A4491	CAPACITOR, noise suppr
	2S1376	NUT, hex: 3/8-32 (radio mtg)
	2S2878	NUT, hex: 1/4-20 (strap mtg)
	3S9694	SCREW, mach: 1/4-20 x 1-1/2 (strap mtg)
		TUNER PARTS
	77D42636A04	TUNER, AT-575: complete
	43K471633	BEARING, ball
	1V564641	CLUTCH & DISC ASSEMBLY
	1V43800A04	COILS & MTG PLATE ASSEM: incls L-2, L-3, L-4 & L-5
	76K563286	CORE, tuning: ant & RF
	76K563288	CORE, tuning: osc
	1B563899	GEAR, BUSHING & DISC ASSEMBLY
	5B562438	GROMMET, core mtg
	1B40875A02	POINTER & ARM ASSEMBLY
	38B563819	PUSHBUTTON
	49A562480	ROLLER, clutch rel
	3A563128	SCREW, set: 4-40 x 1/4 (clutch & disc assembly)
	1V562830	SCREW & NUT ASSEMBLY
	44B40982A07	SHAFT, manual tuning
	41A562449	SPRING, anti-rattle
	41A562447	SPRING, clutch rel
	41B562503	SPRING, pointer tension
	4K692188	WASHER, "C": pointer
	4K501364	WASHER, "C": tuning shaft ret
	4A562431	WASHER, cup

*DENOTES NEW ITEM APPEARING IN ANY LIST FOR FIRST TIME.

automotive stereo 8-track tape player **MANUAL 68P43100A75**

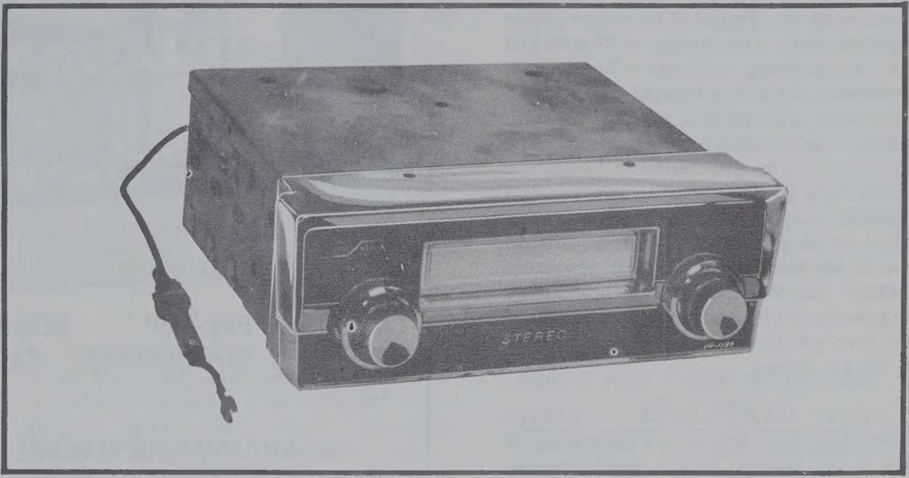
BORG-WARNER
MODEL P6MW

MOTOROLA

service manual

GENERAL INFORMATION

This underdash 8-track stereo tape player contains 11 transistors.



WARRANTY SERVICE STATION PROCEDURE

1. A defective in-guarantee player must be accompanied by the Customer's Guarantee Policy Tag. This tag must be properly filled in by the Borg-Warner dealer at the time of the player purchase. Accept as guarantee repairs only those players within the 6 month guarantee period. The removal or re-installation of this player is customarily performed by the customer and is not covered by this guarantee. Also, the removal of motor noise, tire static, electrical interference and faulty installations are not considered as guarantee repairs and, therefore, expenses related to such services should be handled by the customer.

2. Fill in Motorola Guarantee Labor Claim, Part Number 68P60016A30, and mail Green and Pink copies to:

Motorola Guarantee Service
Motorola, Inc.
9401 West Grand Avenue
Franklin Park, Illinois.

3. The yellow copy of the Motorola Guarantee Labor Claim is to be retained by the authorized service station for his files.

4. Defective parts for guarantee repairs made on this model are to be sent to Motorola.

OPERATING INSTRUCTIONS

OPERATION

TO PLAY TAPES - Turn unit on by inserting a tape cartridge (label side up and open end first) into the tape slot. Push the cartridge in until it is firmly seated. (THIS IS IMPORTANT.) The tape cartridge will now play, in succession, all four channels. Adjust volume, tone and balance as required.

CAUTION: The tape cartridge should always be pulled out completely or approximately 1" from the seated (play) position before leaving car.

TAPE CARTRIDGE CARE

To assure maximum life and noise free operation, tapes should be stored in a cool, clean and dry place, out of the rays of the sun and with the open (tape) end down.

SERVICE NOTES

GENERAL SERVICE NOTES

1. POLARITY - WHEN SERVICING THIS UNIT, THE "A" LEAD MUST BE CONNECTED TO THE POSITIVE SIDE OF POWER SOURCE. IF CONNECTED OTHERWISE, UNIT WILL NOT OPERATE AND DAMAGE TO COMPONENTS MAY RESULT.

2. POWER SUPPLY REQUIREMENTS - It is preferable to use a storage battery (without a battery charger) in place of a battery eliminator. If a battery eliminator is used, it must be well filtered and regulated.

3. OUTPUT LOAD - Always operate this unit with an output load across each of the two channels; either 8 ohm speakers or 8 ohm, 5 watt resistive loads can be used.

4. TRANSISTOR REPLACEMENT - When replacing a transistor other than a power or regulator transistor, grasp the transistor leads between transistor body and plated chassis board with a pair of long nose pliers to prevent excessive heating of transistor body during soldering operation.

5. POWER AND REGULATOR TRANSISTOR REPLACEMENT - When replacing a power or regulator transistor, be sure to:

A. Use the transistor specified in the Replacement Parts List.

B. Coat both sides of transistor insulator with DC-4 grease (Motorola Part No. 11M490487) to insure proper heat dissipation.

C. Securely and evenly tighten the transistor mounting screws.

MOTOROLA INC. 9401 WEST GRAND AVENUE, FRANKLIN PARK, ILLINOIS
PART NO. 68P43100A75 3-67 PRICE 35 CENTS
COPYRIGHT 1967 BY MOTOROLA INC. - PRINTED IN U.S.A.

6. GAINING ACCESS TO THE PLATED BOARDS - Remove top and bottom covers and refer to photo.

Tape Pre-Amp Plated Board - To remove this board for servicing, merely unsolder the chassis ground lead (see photo), bend the copper retaining clip and lift up the chassis to a more serviceable position.

Audio Amplifier Plated Board - To gain access to the bottom side of this board, remove the two (2) screws at the front side of the radio (see photo). To remove the board for servicing, remove the screw from the mounting bracket, unsolder the tabs, straighten the tabs, then remove the mounting bracket.

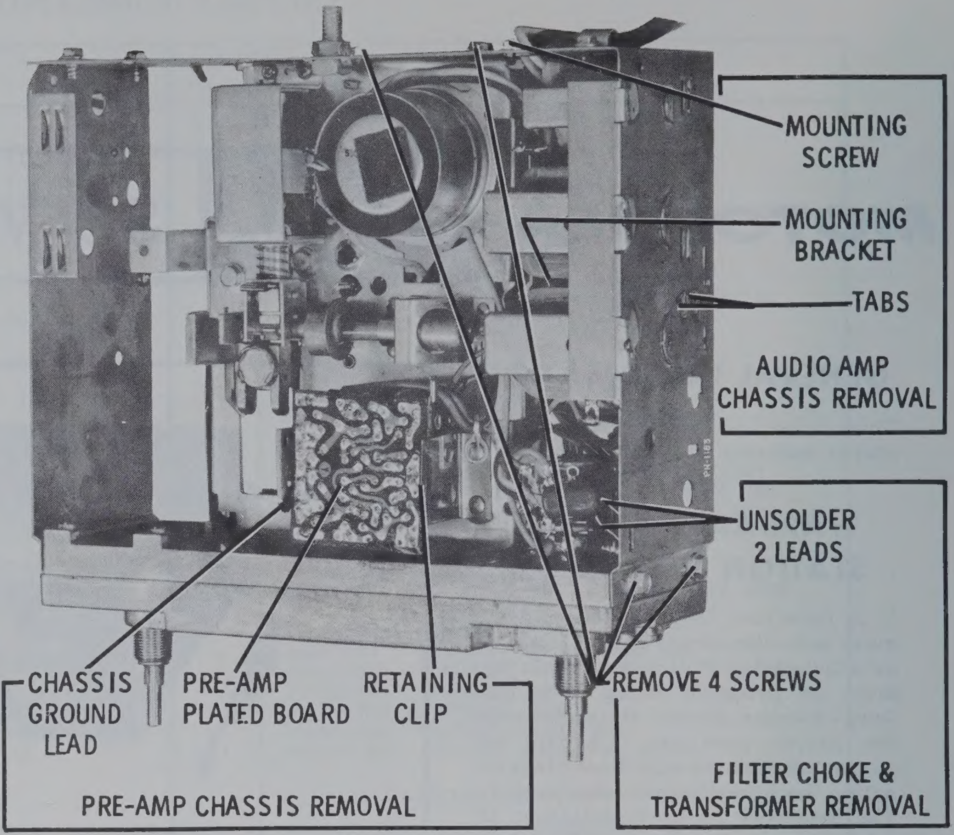
7. OUTPUT TRANSFORMER AND FILTER CHOKE REPLACEMENT - Remove 4 screws, 2 at front side and 2 at rear (see photo); also unsolder control ground leads from wraparound and pull out wraparound far enough to remove transformer or filter choke.

8. TAPE CARTRIDGES - Before servicing the tape player portion of this unit, always check for the possibility of a defective pre-recorded tape cartridge, particularily if one is returned with the unit. This should be done by substituting the tape cartridge with one that is known to be good.

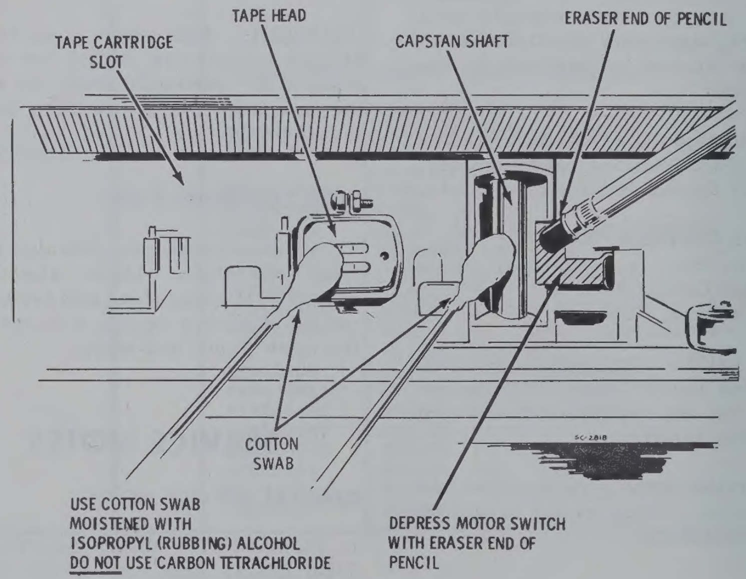
9. TAPE HEAD AND CAPSTAN CLEANING - One major cause of improper tape player operation is oxide build-up on the head and capstan. During normal operation, some iron oxide particules are loosened from the tape and build up. This accumulation of oxide can cause poor playback and up and down tape travel. The head and capstan should be cleaned whenever the unit is serviced and this can be done either in the car or on the service bench. To clean the head and capstan, use a cotton swab moistened with head cleaner or isopropyl alcohol, then wipe dry.

(CAUTION should be exercised when cleaning playback head to prevent getting cleaner on any plastic parts.)

10. HEAD DEMAGNETIZING - Do not use magnetized screwdrivers and wrenches near the head since these can magnetize the head. The head may also, after a long period of time, acquire some residual magnetism. A head that is magnetized will show a definite loss of high frequency response and an increase in noise level. Use a commercially available head demagnetizer, following instructions included with the unit to demagnetize the head.


MOUNTING SCREW
MOUNTING BRACKET
TABS
AUDIO AMP CHASSIS REMOVAL
UNSOLDER 2 LEADS
REMOVE 4 SCREWS
FILTER CHOKE & TRANSFORMER REMOVAL
CHASSIS GROUND LEAD
PRE-AMP PLATED BOARD
RETAINING CLIP
PRE-AMP CHASSIS REMOVAL
PN-1185

GAINING ACCESS TO PLATED BOARDS, FILTER CHOKE AND OUTPUT TRANSFORMERS


TAPE HEAD
TAPE CARTRIDGE SLOT
CAPSTAN SHAFT
ERASER END OF PENCIL
COTTON SWAB
USE COTTON SWAB MOISTENED WITH ISOPROPYL (RUBBING) ALCOHOL DO NOT USE CARBON TETRACHLORIDE
DEPRESS MOTOR SWITCH WITH ERASER END OF PENCIL
SC-2818

TAPE HEAD & CAPSTAN CLEANING

11. HEAD REPLACEMENT - The location of the tape head with respect to its mounting bracket is very critical; for this reason, replacement heads are supplied already secured to their mounting bracket and positioned correctly at the factory. When replacing a head, remember to replace it as an assembly, that is, remove the defective head and bracket and replace it with the new head and bracket assembly.

If for some reason the location of the head has changed (due to a loose mounting screw, etc.), position it as shown in "Head Positioning Adjustment".

ADJUSTMENTS AND LUBRICATION

ADJUSTMENTS

Head adjustments are normally required for cases of cross-talk, loss or noisy frequency response or if the head has been replaced.

A suitable test tape should be used for the azimuth and height adjustments. Motorola has a suitable test tape cartridge available for the field under Part Number 99P43309A01. Instructions, in the form of a label on the cartridge, are included.

Connect 8 ohm loads (either speakers or resistors) across the output of both channels and set tone control to treble (maximum clockwise). Use an oscilloscope or AC output meter and a 1/16" Allen wrench for azimuth and height adjustments (Motorola Part Number 66P40059A32).

HEIGHT

This is an adjustment to move the tape head up or down so that it can be positioned exactly in line with the pre-recorded information on the tape. Misadjustment of this screw would cause cross-talk and/or poor separation.

With the Motorola test tape, proceed as follows:

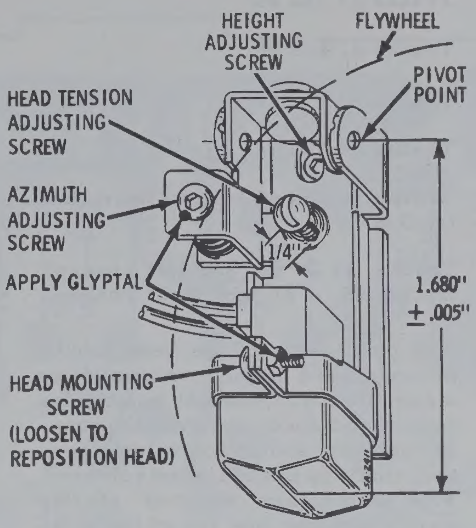
1. Remove top cover and make sure output loads are connected across each channel.

2. Insert test tape cartridge into tape slot and position head to tracks #2 and #6.

3. Set balance control for maximum output from left channel.

4. Connect scope (or VTVM) across left channel output - (track #2 information - 1Kc will be presented). Adjust height adjusting screw for a null. The reason for the null is that the 1Kc information is recorded not on track #2 but on the guard bands adjacent to track #2. This adjustment will minimize cross-talk.

5. Azimuth - Connect scope or VTVM across the output of the right channel and adjust balance control for maximum right channel output - (track #6 information - 8Kc will be presented). Adjust azimuth adjusting screw for maximum output.



HEAD ADJUSTMENTS

6. Repeat Steps #4 and #5 to optimize these adjustments, then cement adjusting screws in place with glyptal (Motorola Part Number 11P40059A53) or other non-hardening cement.

NOTE: Before cementing, index head 4 times and recheck for null; optimize the adjustment.

The next two adjustments are not normally required except when the head has been replaced or tampered with.

HEAD TENSION ADJUSTMENT

This adjustment will have to be made if the head assembly has been replaced. Adjust the screw so that there is 1/4" between the bottom flat of the screw head and the head mounting bracket with head in its lowest position (tracks #4 and #8). Apply glyptal to the screw from the bottom.

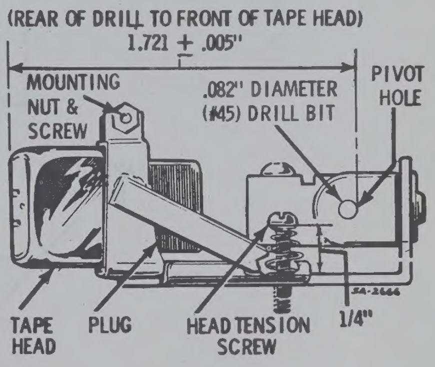
HEAD POSITIONING ADJUSTMENT

Not normally required unless tampering has occurred or if mounting screw has loosened.

The head should be set to 1.680" ± .005" measured from the center of the pivot hole to the front of the head.

Since this dimension is quite critical and may be difficult to gain access to, an alternate method is covered below.

Remove the head and bracket assembly from the tape deck mechanism by first unplugging the cable from the rear of the head, then remove the head tension screw. Loosen the head mounting screw and apply locktite (or other suitable adhesive) to the 4 surfaces of the head where it contacts the bracket. Insert a .082" drill bit (#45 drill) through both pivot holes. With a rule gauge or vernier caliper, adjust the head to 1.721" ± .005" measured from the rear edge of the drill to the front edge of the tape head (see detail). Tighten the head mounting screw and apply glyptal to the mounting nut and screw. Re-install the head and bracket assembly, then adjust the head tension screw to the 1/4" dimension referred to in the detail. Again, apply glyptal to the bottom of this screw. Lastly, perform the azimuth and height adjustments on the head as referred to above.



HEAD POSITIONING

LUBRICATION

Refer to the exploded view on Page 10. The unit is lubricated at the factory and normally no additional lubrication is required; however, if parts are replaced, the following areas should be lubricated with a lightweight, low temperature grease (Motorola Part No. 11P40059A55).

A. Drive surface of cam (39).

B. Ball bearing on end of cam (40).

C. Solenoid plunger (38).

D. Ball bearings in head mounting bracket (63 and 76).

Silicon grease (Dow Corning DC-4 - Motorola Part Number 11M490487) should be applied to the bottom of the capstan shaft (5).

TAPE PLAYER DRIVE AND HEAD POSITIONING

The view shown below is one looking into the tape player from the front with a tape cartridge inserted and operating.

When the tape cartridge is inserted into the tape slot, the front of the tape cartridge activates a micro-switch which, in turn, turns on the tape motor and audio circuitry.

The drive belt on the motor shaft drives the flywheel causing it to rotate. The flywheel shaft (capstan) which presses the tape against the rubber pressure roller (inside the cartridge) drives the tape. The tape guide bracket keeps the tape from riding up and down the head.

Since the pre-recorded tape has four dual channel programs (8 tracks), the head has to be moved to four different height positions with respect to the tape. The sequence of head movement is as follows:

Tracks #1 and #5

Tracks #2 and #6

Tracks #3 and #7

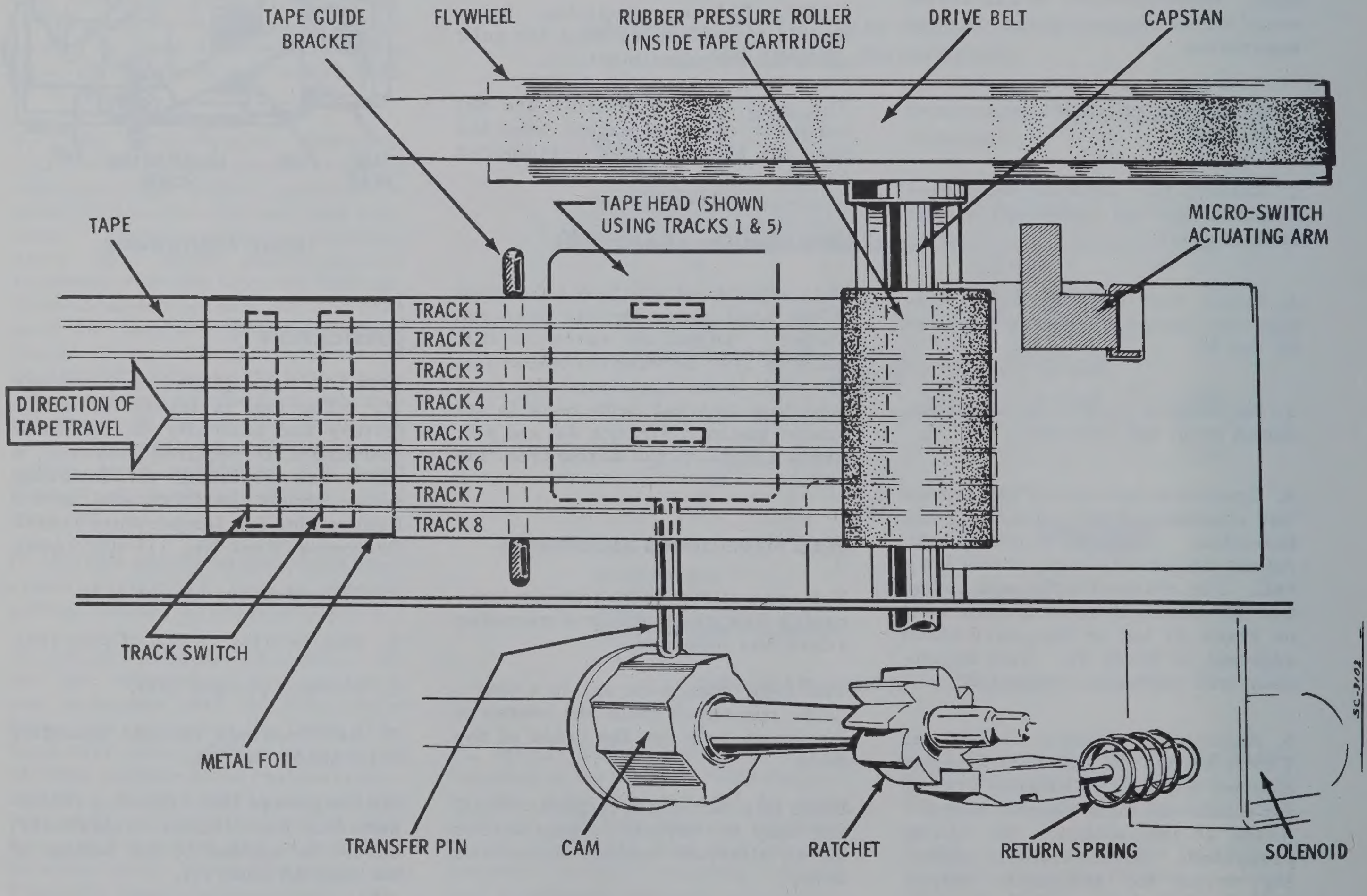
Tracks #4 and #8

Tracks #1 and #5 (return to original tracks)

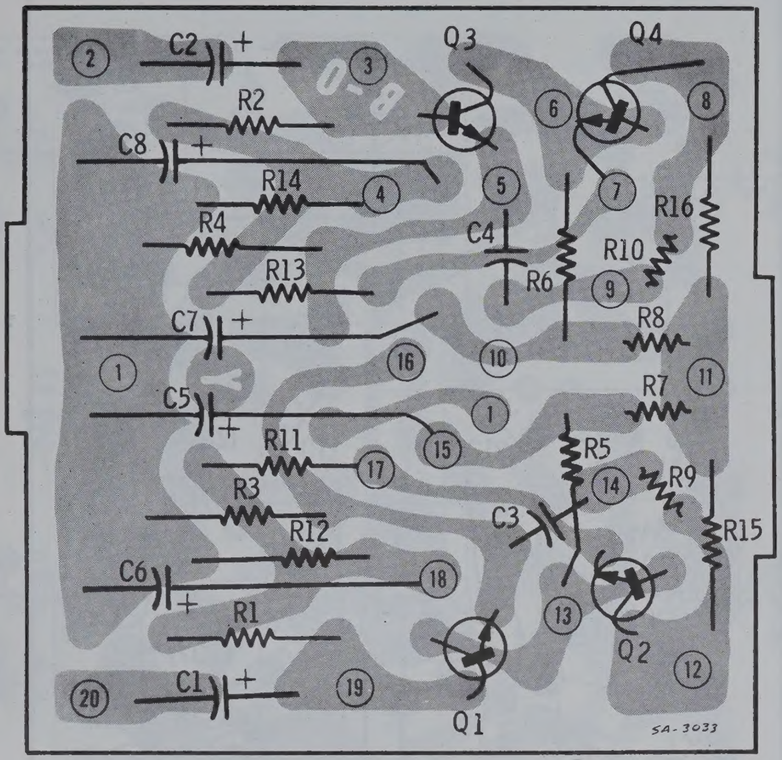
Tracks #1 - #4 are left channel; tracks #5 - #8 are right channel.

The positioning of the head can be accomplished either manually or automatically. Manual positioning is accomplished whenever the channel selector switch (on volume control shaft) is pushed in and released. The momentary shorting of this switch returns one end of the solenoid winding to ground. The resultant magnetic field in the solenoid pulls in the solenoid's spring loaded shaft for an instant; when the shaft returns to its original position, it detents the ratchet end of the cam shaft to its next position. In contact with the irregularly shaped cam is the tape head transfer pin (located beneath the head) which moves the head up or down.

Automatic positioning of the head to the next dual channel program is accomplished by the tape itself when the end of a program is reached. The pre-recorded tape has, at the end of the recorded programs, a strip of metal foil which shorts out the track switch which is in contact with the tape at all times. This switch is wired in parallel with the channel selector switch to start the same action that occurred when the channel selector switch was activated.


TAPE GUIDE BRACKET
FLYWHEEL
RUBBER PRESSURE ROLLER (INSIDE TAPE CARTRIDGE)
DRIVE BELT
CAPSTAN
TAPE
TAPE HEAD (SHOWN USING TRACKS 1 & 5)
MICRO-SWITCH ACTUATING ARM
TRACK 1
TRACK 2
TRACK 3
TRACK 4
TRACK 5
TRACK 6
TRACK 7
TRACK 8
DIRECTION OF TAPE TRAVEL
TRACK SWITCH
METAL FOIL
TRANSFER PIN
CAM
RATCHET
RETURN SPRING
SOLENOID
SC-3102

TAPE DRIVE AND HEAD POSITIONING


Q3
Q4
C2
R2
C8
R14
R4
R13
C7
C5
R11
R3
R12
C6
R1
C1
C4
R6
R16
R10
R8
R7
R5
R9
R15
C3
Q2
Q1
B-0
Y
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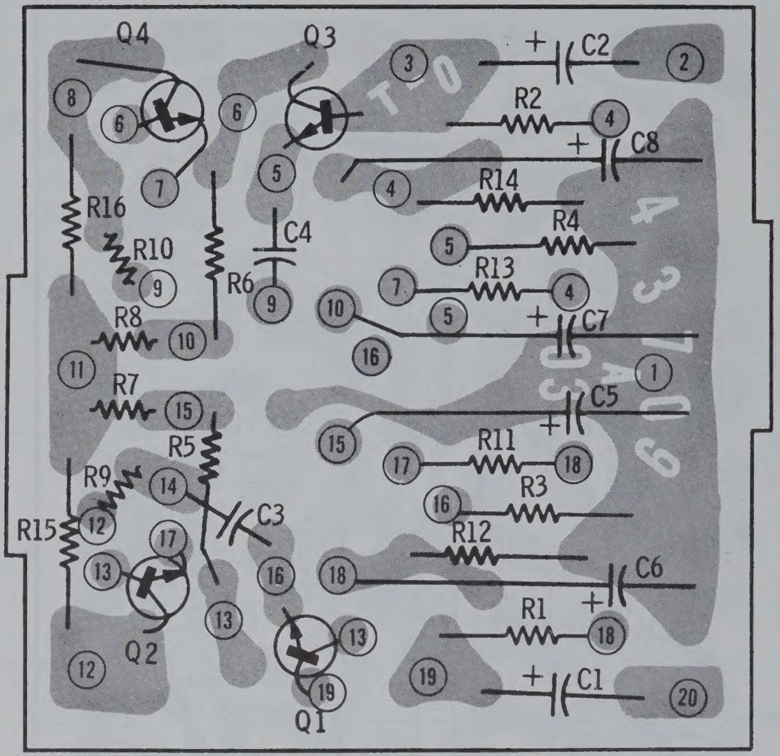
SA-3033

TAPE PRE-AMP - BOTTOM VIEW

PLATED CHASSIS REFERENCE POINTS AND PARTS LOCATION

(VIEW FROM WIRING SIDE OF BOARD)


Q4
Q3
C2
R2
C8
R14
R4
R13
C7
C5
R11
R3
R12
C6
R1
C1
C4
R6
R16
R10
R8
R7
R5
R9
R15
C3
Q2
Q1
T-0
4 3 7 0 9
A
0 3
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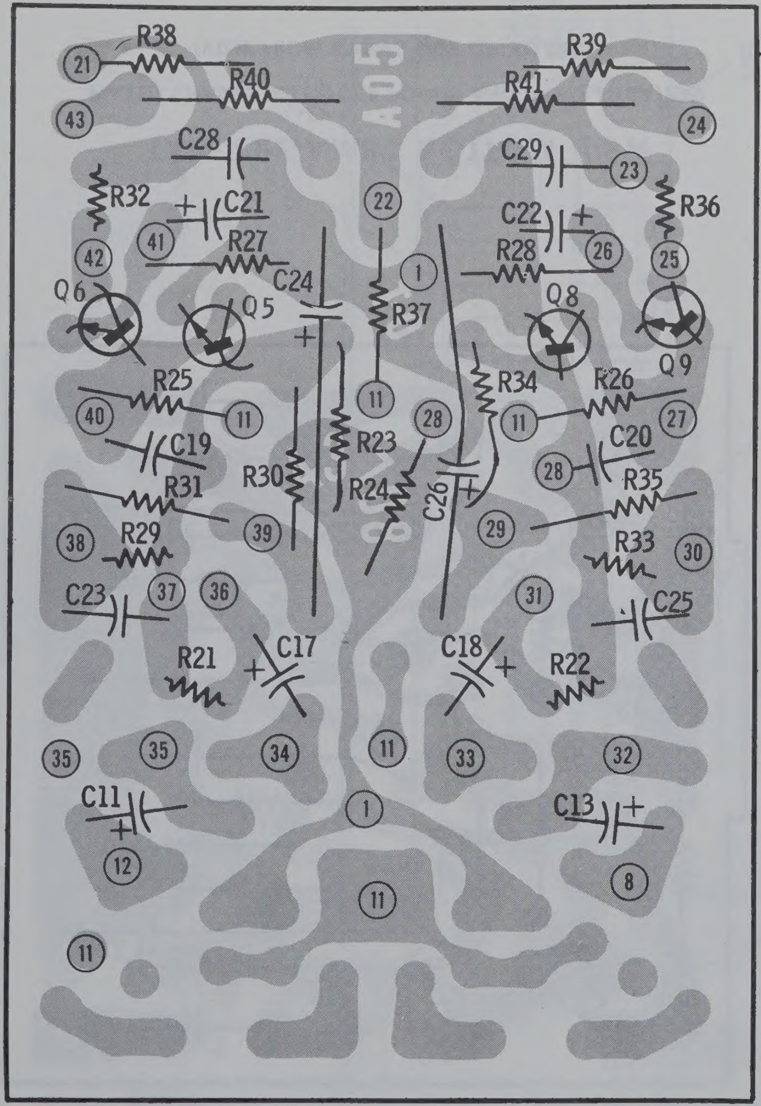
TAPE PRE-AMP - TOP VIEW

PLATED CHASSIS REFERENCE POINTS AND PARTS LOCATION

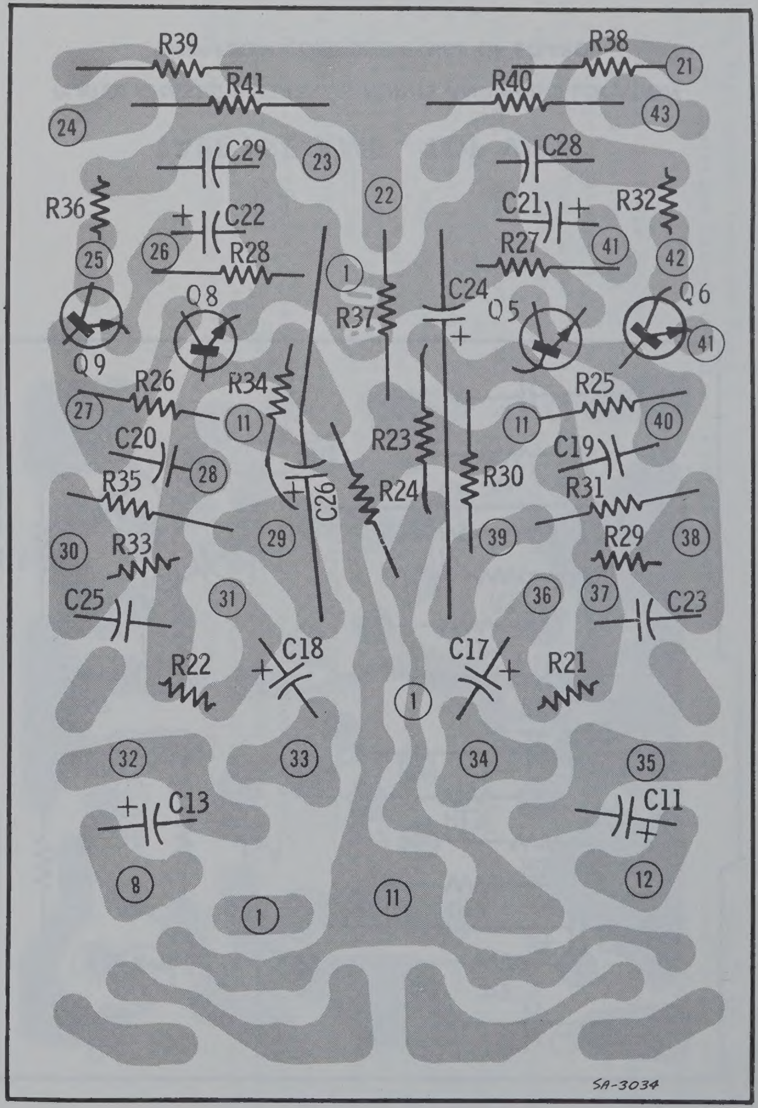
(VIEW FROM COMPONENT SIDE OF BOARD)


R38
R39
R40
R41
A05
C28
C29
R32
C21
R36
C22
R27
R28
C24
R37
Q6
Q5
Q8
Q9
R25
R34
R26
C19
R23
C20
R30
R24
R31
R35
C26
R29
R33
C23
C25
C17
C18
R21
R22
C11
C13

AUDIO AMPLIFIER - TOP VIEW

PLATED CHASSIS REFERENCE POINTS AND PARTS LOCATION

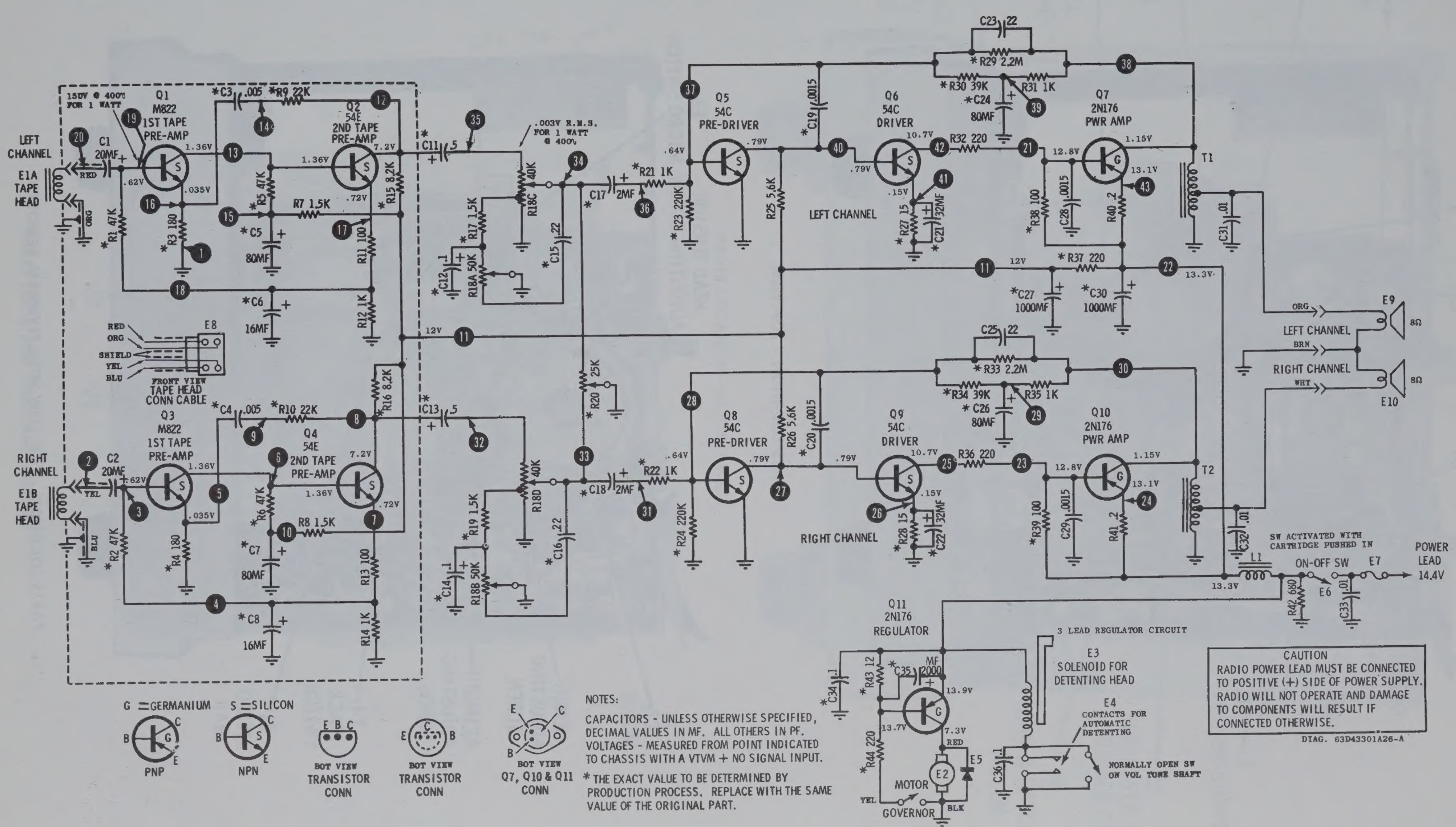
(VIEW FROM COMPONENT SIDE OF BOARD)


R39
R38
R41
R40
C29
C28
R36
C22
C21
R32
R28
R27
R37
C24
Q8
Q5
Q6
Q9
R26
R34
R25
C20
R23
C19
R35
C26
R24
R30
R31
R33
R29
C25
C23
R22
C18
C17
R21
C13
C11
SA-3034

AUDIO AMPLIFIER - BOTTOM VIEW

PLATED CHASSIS REFERENCE POINTS AND PARTS LOCATION

(VIEW FROM WIRING SIDE OF BOARD)

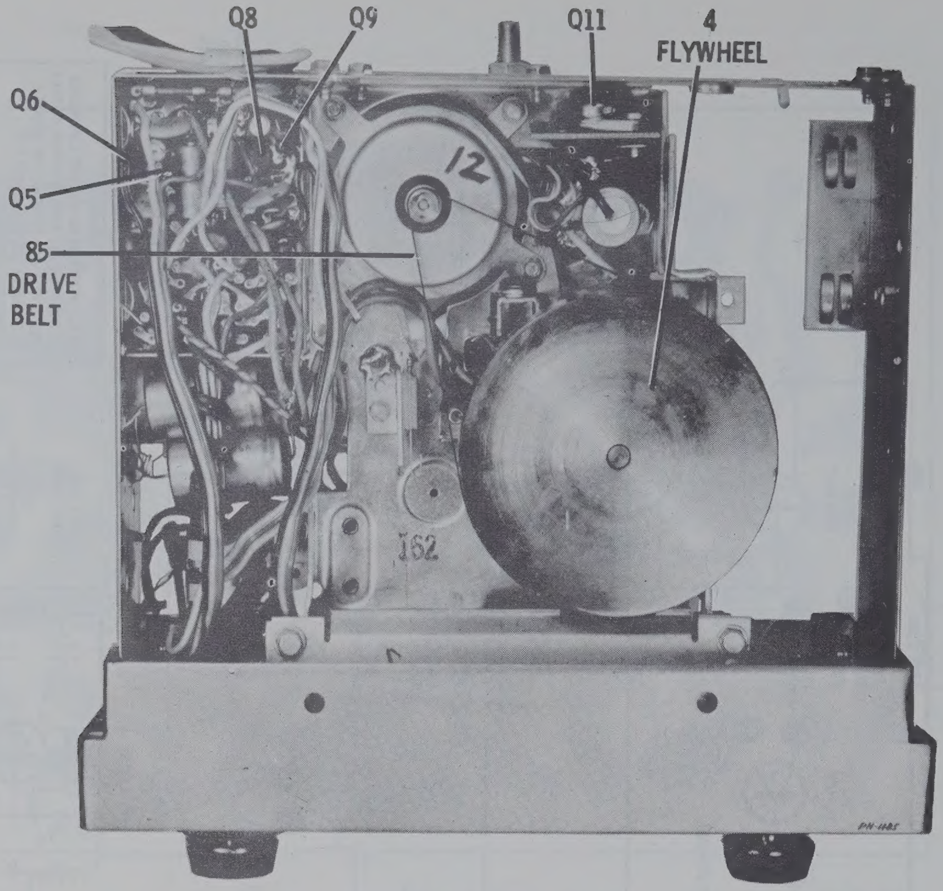

LEFT CHANNEL
E1A TAPE HEAD
RIGHT CHANNEL
E1B TAPE HEAD
150V @ 400~ FOR 1 WATT
Q1 M822 1ST TAPE PRE-AMP
Q2 54E 2ND TAPE PRE-AMP
Q3 M822 1ST TAPE PRE-AMP
Q4 54E 2ND TAPE PRE-AMP
C1 20MF
C2 20MF
*C3 .005
*C4 .005
*C5 80MF
*C6 16MF
*C7 80MF
*C8 16MF
*R1 47K
*R2 47K
*R3 180
*R4 180
*R5 47K
*R6 47K
R7 1.5K
R8 1.5K
*R9 22K
*R10 22K
R11 100
R12 1K
R13 100
R14 1K
*R15 8.2K
*R16 8.2K
RED
ORG
YEL
BLU
SHIELD
E8
FRONT VIEW TAPE HEAD CONN CABLE
*C11 5
*C13 5
.003V R.M.S. FOR 1 WATT @ 400~
R18C 40K
R18D 40K
R17 1.5K
R19 1.5K
R18A 50K
R18B 50K
*C12 .1
*C14 .1
*C15 .22
*C16 .22
*R20 25K
C17 2MF
*C18 2MF
*R21 1K
*R22 1K
*R23 220K
*R24 220K
Q5 54C PRE-DRIVER
Q8 54C PRE-DRIVER
R25 5.6K
R26 5.6K
*C19 .0015
*C20 .0015
Q6 54C DRIVER
Q9 54C DRIVER
*R27 15
*R28 15
*C21 32MF
*C22 32MF
LEFT CHANNEL
RIGHT CHANNEL
R32 220
R36 220
C23 22
C25 22
*R29 2.2M
*R33 2.2M
*R30 39K
*R34 39K
R31 1K
R35 1K
*C24 80MF
*C26 80MF
Q7 2N176 PWR AMP
Q10 2N176 PWR AMP
*R38 100
*R39 100
C28 .0015
C29 .0015
R40 .2
R41 .2
*R37 220
*C27 1000MF
*C30 1000MF
12V
13.3V
T1
T2
C31 .01
C32 .01
ORG
BRN
WHT
LEFT CHANNEL
RIGHT CHANNEL
E9 8Ω
E10 8Ω
L1
SW ACTIVATED WITH CARTRIDGE PUSHED IN
ON-OFF SW
E6
E7
POWER LEAD 14.4V
R42 680
C33 .01
Q11 2N176 REGULATOR
R43 12
*C35 2000 MF
*C34 .1
*R44 220
13.9V
13.7V
7.3V
RED
YEL
BLK
MOTOR
E2
E5
GOVERNOR
3 LEAD REGULATOR CIRCUIT
E3 SOLENOID FOR DETENTING HEAD
E4 CONTACTS FOR AUTOMATIC DETENTING
NORMALLY OPEN SW ON VOL TONE SHAFT
C36 .1
G = GERMANIUM
S = SILICON
PNP
NPN
E B C
BOT VIEW TRANSISTOR CONN
BOT VIEW TRANSISTOR CONN
BOT VIEW Q7, Q10 & Q11 CONN
DIAG. 63D43301A26-A

NOTES:

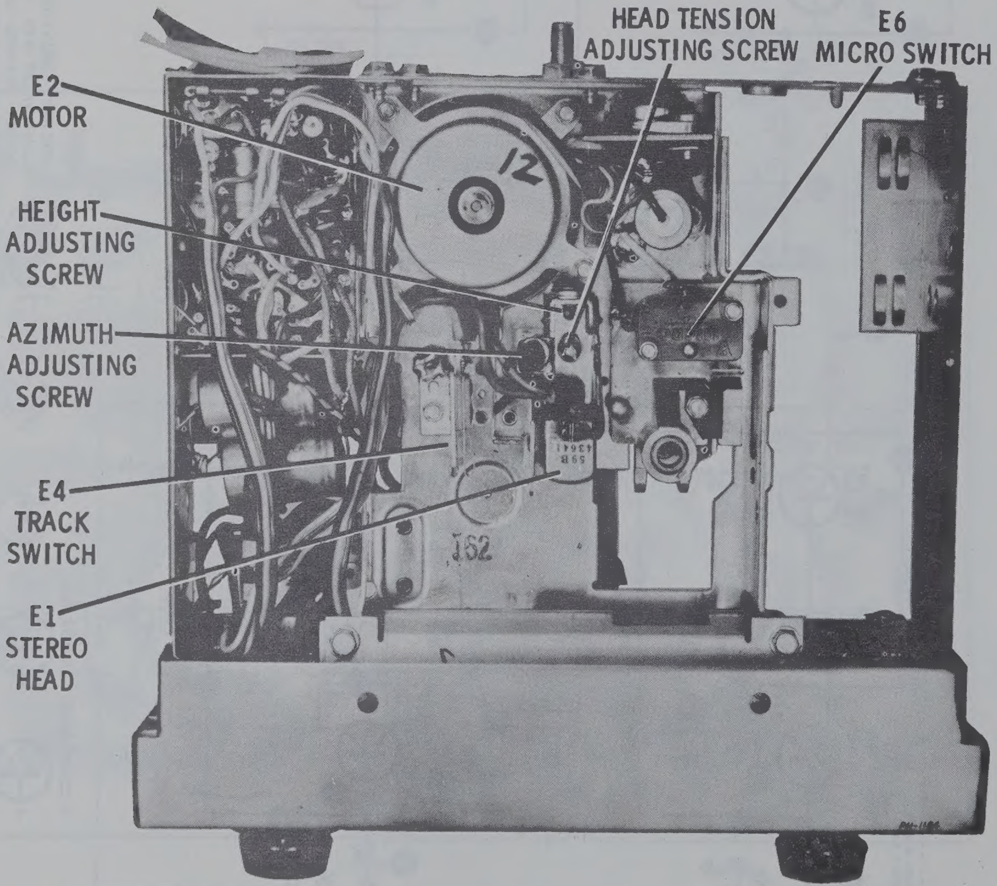
CAPACITORS - UNLESS OTHERWISE SPECIFIED, DECIMAL VALUES IN MF. ALL OTHERS IN PF.
VOLTAGES - MEASURED FROM POINT INDICATED TO CHASSIS WITH A VTVM + NO SIGNAL INPUT.
* THE EXACT VALUE TO BE DETERMINED BY PRODUCTION PROCESS. REPLACE WITH THE SAME VALUE OF THE ORIGINAL PART.

CAUTION
RADIO POWER LEAD MUST BE CONNECTED TO POSITIVE (+) SIDE OF POWER SUPPLY. RADIO WILL NOT OPERATE AND DAMAGE TO COMPONENTS WILL RESULT IF CONNECTED OTHERWISE.

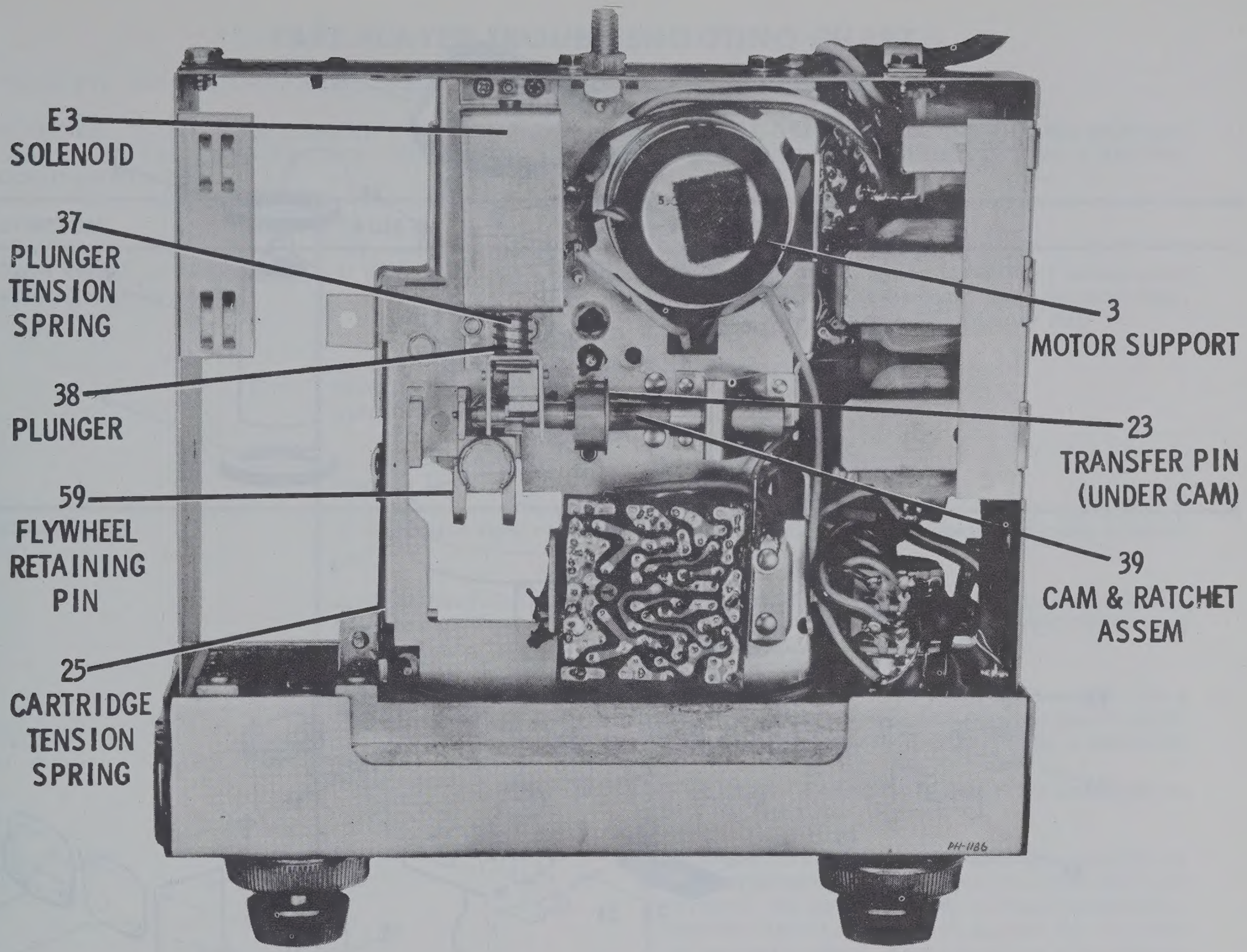
SCHEMATIC DIAGRAM


Q8
Q9
Q11
4
FLYWHEEL
Q6
Q5
85
DRIVE
BELT

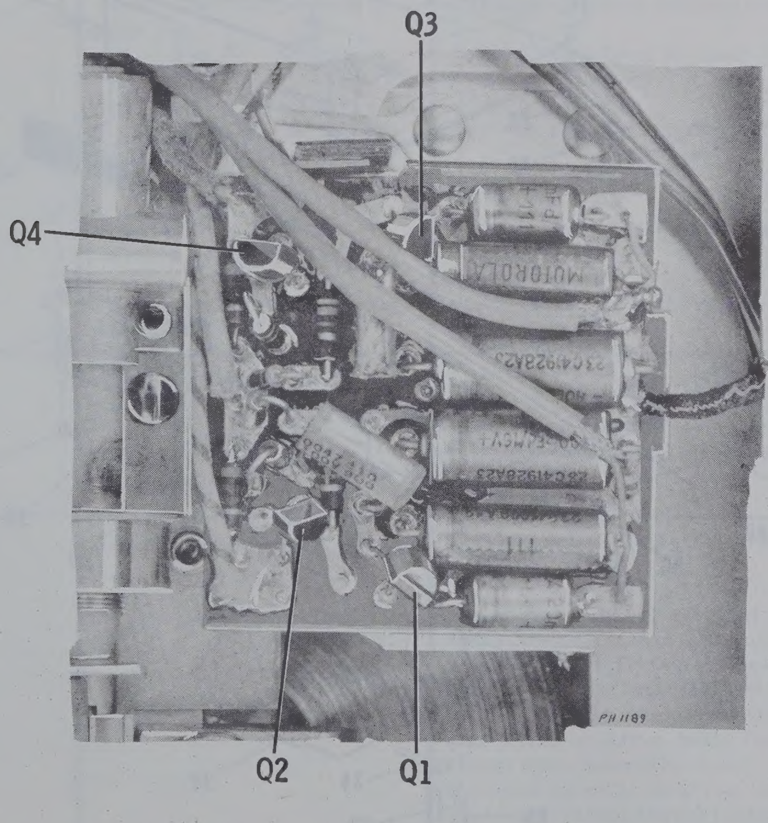
PARTS LOCATION - TOP VIEW


HEAD TENSION
ADJUSTING SCREW
E6
MICRO SWITCH
E2
MOTOR
HEIGHT
ADJUSTING
SCREW
AZIMUTH
ADJUSTING
SCREW
E4
TRACK
SWITCH
E1
STEREO
HEAD

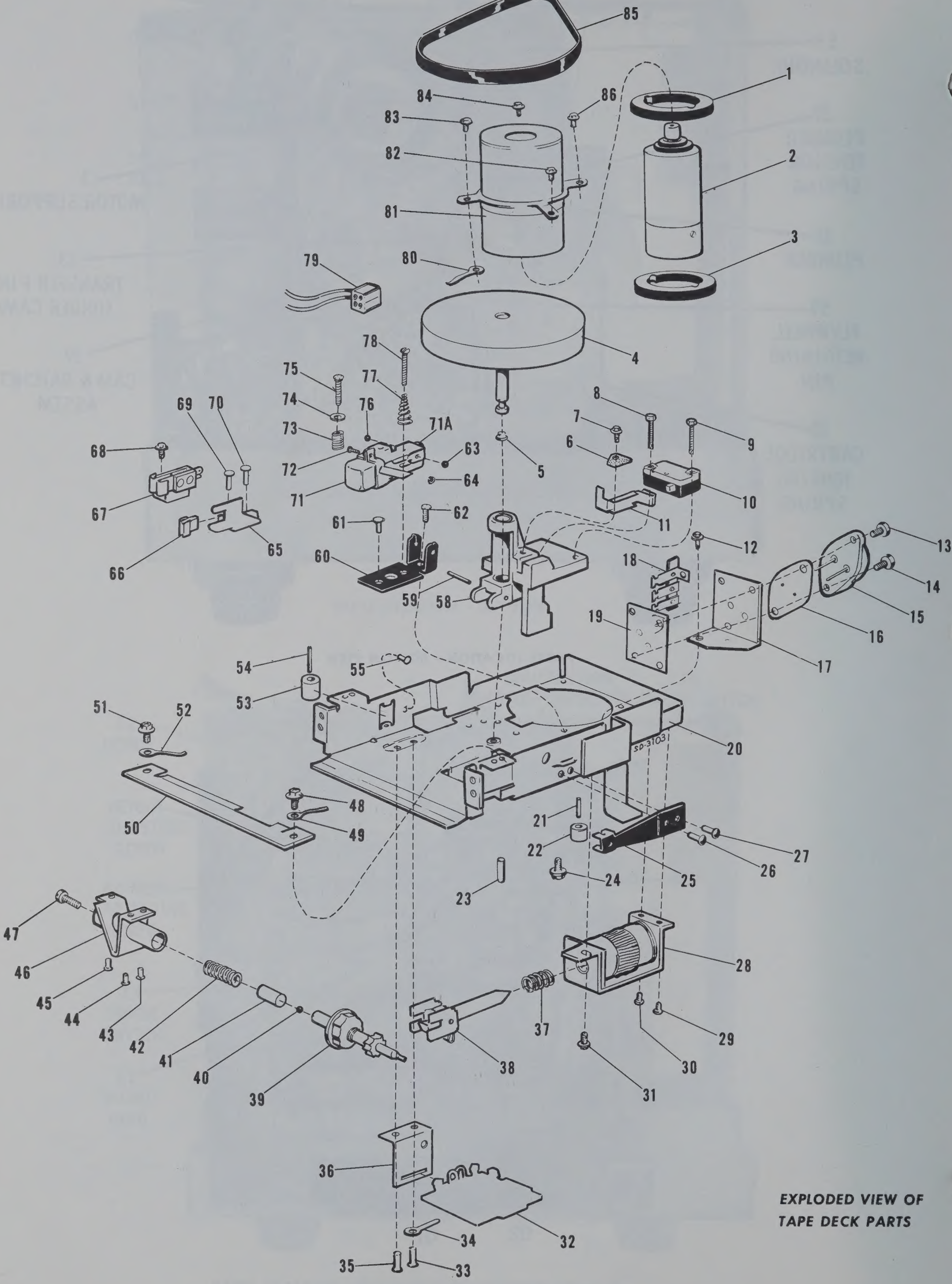
PARTS LOCATION - TOP VIEW WITH FLYWHEEL REMOVED


E3
SOLENOID
37
PLUNGER
TENSION
SPRING
38
PLUNGER
59
FLYWHEEL
RETAINING
PIN
25
CARTRIDGE
TENSION
SPRING
3
MOTOR SUPPORT
23
TRANSFER PIN
(UNDER CAM)
39
CAM & RATCHET
ASSEM
PH-1186

PARTS LOCATION - BOTTOM VIEW


Q3
Q4
Q2
Q1
MOTOROLA
PH 1189

PARTS LOCATION - PRE-AMP CHASSIS


85
1
84
86
83
82
2
81
3
79
80
4
78
75
77
74
76
71A
73
63
72
71
64
68
69
70
67
65
66
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
58
59
60
61
62
54
55
53
51
52
50
48
49
20
SD-3103
21
22
23
24
25
26
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33

EXPLODED VIEW OF TAPE DECK PARTS

TAPE PLAYER TROUBLESHOOTING CHART

NOTE #1: DO NOT OPERATE TAPE PLAYER UPSIDE DOWN - CARTRIDGE MAY JAM.

NOTE #2: MANY TAPE PLAYER PROBLEMS CAN BE CAUSED BY DEFECTIVE CARTRIDGES; BEFORE SERVICING THE TAPE PLAYER, CHECK FOR A DEFECTIVE CARTRIDGE BY SUBSTITUTING A KNOWN GOOD CARTRIDGE.

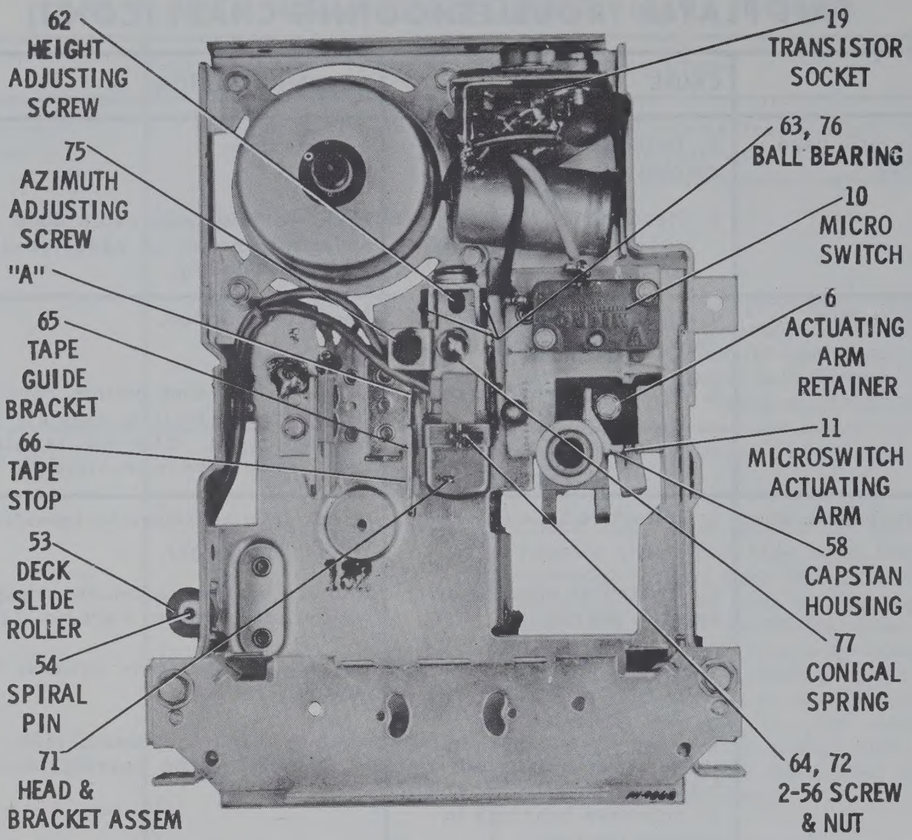
SYMPTOM	CAUSE	POSSIBLE SOLUTION
Tape breaks or winds up around capstan shaft.	1. Defective tape cartridge.	Check tape cartridge by inserting a known good tape cartridge. Before inserting new cartridge, examine actuating arm (see Cause #2).
	2. Bent or burred edge on front of micro-switch actuating arm (11).	Replace arm.
	3. Defective capstan housing (58).	Replace capstan housing.
Cross-talk.	1. Defective tape cartridge.	Check tape cartridge by substitution with a known good tape cartridge.
	2. Tape head (71) out of adjustment.	Check head height and azimuth adjustments with a test tape (Motorola Part No. 99P43309A01) as outlined in "Adjustments" section.
	3. Head mounting bracket (71A) binding.	Grasp at rear of head mounting bracket with a pair of long nose pliers and squeeze gently while moving head up and down until binding is relieved. CAUTION: Do not apply excessive pressure as ball bearings may pop out. To check this adjustment, index tape head to its lowest position (tracks #4 and #8), then with unit vertical, lift up tape head; it should have sufficient tension to spring back against the transfer pin without binding. Also check for 1/4" adjustment of head tension adjusting screw (see "Adjustments").
	4. Tape guide bracket (65) not positioning tape correctly with respect to tape head.	Check distance between bottom edge of tape guide bracket and chassis; it should be .090" - .095". If it is not, bend or replace the tape guide bracket. CAUTION: Bend at point "A" not at the two (2) tines (see photo).
	5. Thrust plate on bottom of capstan housing (58) loose or missing.	Replace capstan housing.
	6. Defective cam and ratchet assembly (39).	Replace cam and ratchet assembly.
	7. Tape head not indexing correctly.	See "Improper or Erratic Head Indexing".
Motor runs fast.	1. Defect in regulator circuitry.	Check regulator transistor by shorting base to emitter of regulator transistor (to remove forward bias), motor should stop; if it does not, regulator transistor is shorted.
	2. Defective motor (2).	Replace.
Slow speed (also see "Poor Tape Drive").	1. Defective tape cartridge.	Check tape cartridge by inserting a known good cartridge.
	2. Mechanical binding.	Check for binding by first removing tape cartridge, turn on motor with micro-switch actuating arm and check flywheel speed with a strobe disc (Motorola Part Number 68P40059A33 or equivalent). If speed is excessively slow, shut off unit and remove drive belt; flywheel should move freely when turned by hand. If it does not, check for missing nylon bearing on bottom of flywheel, loose or missing thrust plate at bottom of capstan housing, defective bearings in capstan housing or defective flywheel.

TAPE PLAYER TROUBLESHOOTING CHART (CON'T)

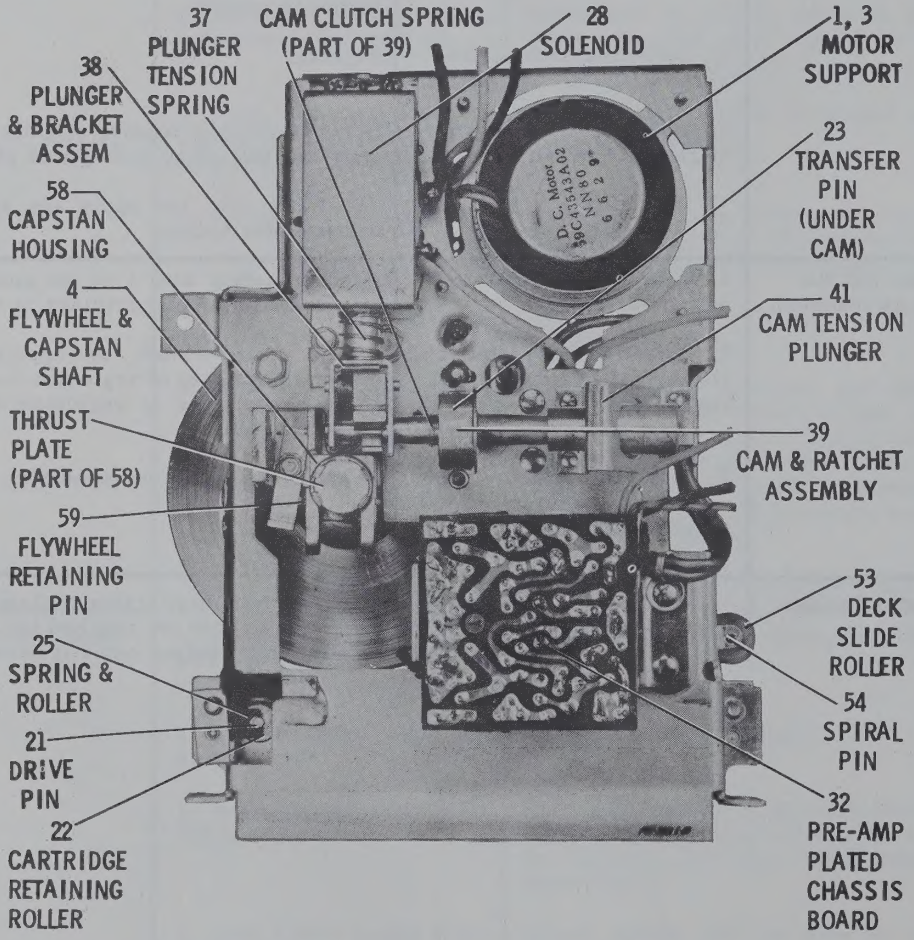
SYMPTOM	CAUSE	POSSIBLE SOLUTION
Slow speed (also see "Poor Tape Drive"). (Cont'd)		If flywheel moves freely when turned by hand, check for defective drive belt, tape cartridge or electrical problem (see Cause #3).
	3. Electrical defects. A. Open regulator filter capacitor (C-35).	Replace C-35.
	B. Defective motor (2).	Check motor by grounding motor governor (junction of yellow motor wire and R-44) for an instant, motor should speed up; if motor does not speed up, motor is defective. If motor does speed up, check voltages in regulator circuitry.
Poor tape drive, wow and flutter (also see "Slow Speed").	1. Defective tape cartridge.	Check tape cartridge by inserting a known good tape.
	2. Insufficient tension on tape cartridge.	Check cartridge tension by pulling cartridge slightly away from tape head, then release; the cartridge should snap back into place and there should be no end play on the right side of the cartridge. If the cartridge does not snap in or there is end play, replace the spring and roller (25). Make sure mounting screw does not protrude too far to interfere with cartridge. Also, with cartridge inserted, the roller (53) on the left side should be in contact with the cartridge. If it is not, replace the roller (Motorola Part Number 49A43659A03).
	3. Flywheel (4) and/or motor drive shaft (part of 2) dirty or greasy.	Use isopropyl (rubbing) alcohol to clean the following areas: outer edge of flywheel, motor drive shaft and capstan shaft.
	4. Defective or incorrectly installed drive belt (85).	Drive belt should be replaced if stretched or banana shaped; belt should be installed with paint stripe on outside.
	5. Cartridge retaining roller (22) not seated properly or missing.	Make certain roller is seated in spring (25); replace if missing.
	6. Scraping cartridge.	Examine left side of tape cartridge; if severely scored, lightly file off any burrs on left front edge of tape slot or escutcheon.
	7. Scored capstan shaft (part of 4).	Replace; if severely scored, replace capstan housing (58) also.
	8. Bent motor housing (81).	With cartridge inserted and operating, make certain drive belt rides on center of brass motor pulley; bend the motor housing using wide jawed pliers if necessary. If belt rides too high, bend the housing away from the capstan; if belt rides too low (rubs against housing), bend the housing toward the capstan. CAUTION: Do not bend the brass motor pulley.
Improper or erratic head indexing.	1. Inadequate tension on solenoid plunger tension spring (37).	Increase tension on spring or replace.
	2. Defective solenoid plunger (38).	Replace solenoid plunger.
	3. Head tension screw (78) out of adjustment.	Set the height of the screw so that there is 1/4" between bottom flat portion of the screw head and the head bracket (see "Head Adjustment Location" detail).
	4. Cam clutch spring (part of 39) out of hole or missing.	Insert spring into its hole or replace cam if spring is missing.

TAPE PLAYER TROUBLESHOOTING CHART (CON'T)

SYMPTOM	CAUSE	POSSIBLE SOLUTION
Improper or erratic head indexing (Cont'd)	5. Defective cam and ratchet assembly (39).	Replace cam.
	6. Head cable (79) binding.	Make certain head cable does not restrict up-and-down motion of head; dress head cable to minimize binding.
Motor noise from tape motor.	1. Open regulator filter capacitor (C-35).	Replace capacitor.
	2. Motor grounded to cover.	Check to see that bottom cover has an armite disc attached to it to insulate the motor case from the cover. If the disc is missing, electrical tape can be used to insulate the motor.
Squeaking or excessive wow.	1. Defective tape cartridge.	Check tape cartridge by inserting a known good cartridge.
	2. Broken or missing nylon capstan bearing (5).	Replace bearing; lubricate replacement bearing with silicon grease, Part No. 11M490487.
	3. Scored capstan shaft (part of 4).	Replace; if severely scored, replace capstan housing (58) also.
	4. Thrust plate (part of 58) loose or missing from bottom of capstan housing or defective bearings in capstan housing.	Replace capstan housing (58). Do not attempt to lubricate oilite bearings in capstan housing.
Drive belt slips off flywheel (also slow tape start up).	1. Defective or incorrectly installed drive belt (85).	Drive belt should be replaced if stretched or banana shaped; belt should be installed with paint stripe on outside.
	2. Loose motor mounting screws (82, 83, 84 and 86).	Tighten.
	3. Motor drive shaft (part of 2) not vertical.	Bend the motor housing slightly away from the capstan shaft using wide jawed pliers. CAUTION: Do not apply any pressure to the brass motor pulley.
Tape motor does not run when cartridge is inserted.	1. Micro-switch (10) not activated.	Bend actuating arm (11) far enough to activate micro-switch when cartridge is inserted.
	2. Defective micro-switch (10) or defect in motor or regulator circuit.	Check micro-switch by applying B+ voltage directly to emitter of regulator transistor. Also compare voltages in regulator circuit to those on schematic.
	3. Shorted regulator filter capacitor (C-35) or defective regulator transistor.	Replace suspected component(s).
Intermittent audio during tape operation.	1. Loose or intermittent head cable (79).	Make certain head cable is firmly plugged into head. Cable can be checked for intermittent(s) by wiggling; replace cable if necessary.


62 HEIGHT ADJUSTING SCREW
75 AZIMUTH ADJUSTING SCREW
"A"
65 TAPE GUIDE BRACKET
66 TAPE STOP
53 DECK SLIDE ROLLER
54 SPIRAL PIN
71 HEAD & BRACKET ASSEM
19 TRANSISTOR SOCKET
63, 76 BALL BEARING
10 MICRO SWITCH
6 ACTUATING ARM RETAINER
11 MICROSWITCH ACTUATING ARM
58 CAPSTAN HOUSING
77 CONICAL SPRING
64, 72 2-56 SCREW & NUT

TOP VIEW


37 PLUNGER TENSION SPRING
CAM CLUTCH SPRING (PART OF 39)
28 SOLENOID
1, 3 MOTOR SUPPORT
38 PLUNGER & BRACKET ASSEM
58 CAPSTAN HOUSING
4 FLYWHEEL & CAPSTAN SHAFT
THRUST PLATE (PART OF 58)
59 FLYWHEEL RETAINING PIN
25 SPRING & ROLLER
21 DRIVE PIN
22 CARTRIDGE RETAINING ROLLER
D. C. Motor
23 TRANSFER PIN (UNDER CAM)
41 CAM TENSION PLUNGER
39 CAM & RATCHET ASSEMBLY
53 DECK SLIDE ROLLER
54 SPIRAL PIN
32 PRE-AMP PLATED CHASSIS BOARD

BOTTOM VIEW

TAPE DECK PARTS LOCATION

REPLACEMENT PARTS LIST

Ref. No.	Part Number	Description	List Price
		ELECTRICAL PARTS	
CAPACITORS - NOTE:		The capacitors in this list are recommended replacement types for the original equipment; all are ceramic disc type unless otherwise specified.	
C-1 thru C-8	---	SEE TAPE DECK PARTS	
C-11	23C43280A21	.5 mf +40-20% 15V lytic.	.30
C-12	23C43280A14	.1 mf 15V lytic	.35
C-13	23C43280A21	.5 mf +40-20% 15V lytic.	.30
C-14	23C43280A14	.1 mf 15V lytic	.35
C-15	21C41680A15	.22 mf +80-20% 12V	.35
C-16	21C41680A15	.22 mf +80-20% 12V	.35
C-17	23C43280A02	2 mf +40-20% 10V lytic	.45
C-18	23C43280A02	2 mf +40-20% 10V lytic	.45
C-19	21D40339A87	.0015 mf 10% 100V	.20
C-20	21D40339A87	.0015 mf 10% 100V	.20
C-21	23C41928A33	32 mf 10V lytic	.65
C-22	23C41928A33	32 mf 10V lytic	.65
C-23	21D40536A50	22 pf 10% 100V N150 (USE 21S120539)	.25
C-24	23C41928A23	80 mf 16V lytic	.65
C-25	21D40536A50	22 pf 10% 100V N150 (USE 21S120539)	.25
C-26	23C41928A23	80 mf 16V lytic	.65
C-27	23C41928A29	1000 mf 16V lytic	1.65
C-28	21D40339A87	.0015 mf 10% 100V	.20
C-29	21D40339A87	.0015 mf 10% 100V	.20
C-30	23C41928A29	1000 mf 16V lytic	1.65
C-31	21D40339A78	.01 mf +80-20% 100V (USE 21S132103)	.25
C-32	21D40339A78	.01 mf +80-20% 100V (USE 21S132103)	.25
C-33	21D40339A78	.01 mf +80-20% 100V (USE 21S132103)	.25
C-34, C-35	---	SEE TAPE DECK PARTS	
C-36	8C40906A05	.1 mf 20% 100V mylar	.35
MISCELLANEOUS ELECTRICAL PARTS			
E-1 thru E-6	---	SEE TAPE DECK PARTS	
E-7	65R122346	FUSE, 7.5 amp	.07
E-8	---	SEE TAPE DECK PARTS	
E-9	50C40740B01	SPEAKER, 5-1/4 PM: 8Ω VC	8.40
E-10	50C40740B01	SPEAKER, 5-1/4 PM: 8Ω VC	8.40
COILS & CHOKES			
L-1	25D43221A24	CHOKE, filter	3.95
RESISTOR & CONTROLS			
R-1 thru R-16	---	SEE TAPE DECK PARTS	
R-17	6S127803	1500 10% 1/4 W	.17
R-18	18C40483B02	CONTROL, multiple	9.60
R-19	6S127803	1500 10% 1/4W	.17
R-20	18B40482B01	CONTROL, balance	1.30
R-21	6S127802	1000 10% 1/4W	.17
R-22	6S127802	1000 10% 1/4W	.17
R-23	6S129147	220K 10% 1/4W	.17
R-24	6S129147	220K 10% 1/4W	.17
R-25	6S129433	5600 10% 1/4W	.17
R-26	6S129433	5600 10% 1/4W	.17
R-27	6S131377	15 10% 1/4W	.17
R-28	6S131377	15 10% 1/4W	.17
R-29	6S127001	2.2 meg 10% 1/2W	.17
R-30	6S128903	39K 10% 1/4W	.17
R-31	6S121301	1000 10% 1/2W	.17
R-32	6S127800	220 10% 1/4W	.17
R-33	6S127001	2.2 meg 10% 1/2W	.17
R-34	6S128903	39K 10% 1/4W	.17
R-35	6S121301	1000 10% 1/2W	.17
R-36	6S127800	220 10% 1/4W	.17
R-37	6S127099	220 10% 1/2W	.17
R-38	6S129753	100 10% 1/4W	.17
R-39	6S129753	100 10% 1/4W	.17
R-40	17B40756A04	.20 5% WW PTC (USE 17B40756A06)	.25
R-41	17B40756A04	.20 5% WW PTC (USE 17B40756A06)	.25
R-42	6S129101	680 10% 1/2W	.17
R-43, R-44	---	SEE TAPE DECK PARTS	

Ref. No.	Part Number	Description	List Price
TRANSFORMERS			
T-1	25D41307B05	OUTPUT	1.55
T-2	25D41307B07	OUTPUT	1.55
TRANSISTORS			
Q-1 thru Q-4	---	SEE TAPE DECK PARTS	
Q-5	48S134810	54C	1.45
Q-6	48S134810	54C	1.45
Q-7	48S134747	2N176	3.25
Q-8	48S134810	54C	1.45
Q-9	48S134810	54C	1.45
Q-10	48S134747	2N176	3.25
Q-11	---	SEE TAPE DECK PARTS	
		MECHANICAL PARTS	
	84D43708A05	BOARD, plated chassis: audio; less all components	2.10
	3A40730A03	BOLT, spcl: 1/4-20; sq. hd (radio mtg)	.03
	15D40565B01	COVER, bottom; player	.70
	15D40686B01	COVER, radio trim: blk	1.20
	15D40563B01	COVER, top; player	.65
	15C40570B01	DOOR, tape cartridge	.55
	13D40572B01	ESCUTCHEON, trim	7.80
	13C40658B01	GRILLE, speaker	1.60
	15C40810B01	HOUSING, spkr	1.95
	14A543810	INSULATOR, trans	.10
	36K565237	KNOB, pendant	.95
	36B564318	KNOB, vol-bal-channel chge.	.90
	2B43951A01	NUT, clip-on: #8-15 (spkr mtg to hsg)	.03
	2S135435	NUT, hex: 1/4-20 (to secure mtg bolt)	.03
	9C41095A26	RECEPTACLE, fuse: incl fuse	1.00
	47A43513A02	ROD, cartridge door	.15
	3K560695	SCREW, spcl: trans mtg	.03
	3B40410A07	SCREW, tpg: #8-15 x 1-1/4 (spkr mtg to hsg)	.10
	9C43089A01	SOCKET, trans	.25
	41A43588A01	SPRING, cartridge door	.15
	46K565358	STUD, trimount: trim cover.	.10
		INSTALLATION PARTS	
	1V40400B91	PLAYER INSTALLATION KIT	3.60
	45K538873	ARM, adaptor: fuse recept	.05
	7A40566B02	BRACKET, player mtg	.15
	9A60992A01	CONNECTOR, wire: plastic	.05
	2S135435	NUT, hex: 1/4-20 (rear player mtg)	.03
	2S124821	NUT, hex: 1/2-28 (player mtg to front escut)	.15
	2S115123	NUT, lock: 10-32 x 3/8	.10
	3S125927	SCREW, mach: 10-32 x 3/8; (mts player to brkt - floor mtg)	.03
	3S135712	SCREW, tpg: #8-32 x 1/4; pol chr (player brkt to escut)	.05
	3S135757	SCREW, tpg: 10-12 x 1/2 (spkr hsg to dash)	.03
	3S135885	SCREW, tpg: 10-12 x 1; SL HEX HD (mts bracket to floor - floor mtg)	.05
	42K565362	STRAP, radio mtg	.30
		WTD-90 TAPE DECK	
CAPACITORS - NOTE:		The capacitors in this list are recommended replacement types for the original equipment; all are ceramic disc type unless otherwise specified.	
		ELECTRICAL PARTS	
C-1	23C41928A24	20 mf 16V lytic	.65
C-2	23C41928A24	20 mf 16V lytic	.65
C-3	8C42750A20	.005 mf 10% 100V mylar (USE 8C40906A27)	.30
C-4	8C42750A20	.005 mf 10% 100V mylar (USE 8C40906A27)	.30
C-5	23C41928A23	80 mf 16V lytic	.65
C-6	23C41928A06	16 mf 16V lytic	.90
C-7	23C41928A23	80 mf 16V lytic	.65

Ref. No.	Part Number	Description	List Price
C-8	23C41928A06	16 mf 16V lytic..........	.90
C-34	8C40906A05	.1 mf 20% 100V mylar.....	.35
C-35	23C41928A30	2000 mf 4V lytic.........	1.25
MISCELLANEOUS ELECTRICAL PARTS			
E-1	1V40800B98	STEREO HEAD & MTG BRKT ASSEM.....................	14.50
E-2	59C43543A02	MOTOR, regulated DC........	18.75
E-3	80B43685A01	SOLENOID...................	3.70
E-4	40B43642A01	SWITCH, leaf contact.......	1.20
E-5	48A41508A01	RECTIFIER, silicon.........	.80
E-6	40B43677A01	SWITCH, micro..............	2.00
E-8	30C40643B02	CABLE, stereo head.........	1.35
RESISTORS			
R-1	6S128902	47K 10% 1/4W..............	.17
R-2	6S128902	47K 10% 1/4W..............	.17
R-3	6S129662	180 10% 1/4W..............	.17
R-4	6S129662	180 10% 1/4W..............	.17
R-5	6S128902	47K 10% 1/4W..............	.17
R-6	6S128902	47K 10% 1/4W..............	.17
R-7	6S127513	1500 10% 1/2W.............	.17
R-8	6S127513	1500 10% 1/2W.............	.17
R-9	6S125568	22K 10% 1/2W..............	.17
R-10	6S125568	22K 10% 1/2W..............	.17
R-11	6S129753	100 10% 1/4W..............	.17
R-12	6S127802	1000 10% 1/4W.............	.17
R-13	6S129753	100 10% 1/4W..............	.17
R-14	6S127802	1000 10% 1/4W.............	.17
R-15	6S128686	8200 10% 1/4W.............	.17
R-16	6S128686	8200 10% 1/4W.............	.17
R-43	6S128224	12 10% 1/2W...............	.17
R-44	6S127099	220 10% 1/2W..............	.17
TRANSISTORS			
Q-1	48S134823	M822.......................	1.50
Q-2	48S134846	54E........................	1.50
Q-3	48S134823	M822.......................	1.50
Q-4	48S134846	54E........................	1.50
Q-11	48S134746	2N176 (USE 48S134747)......	3.25
		MECHANICAL PARTS	
1	7A43576A01	SUPPORT, motor: rubber.....	.15
2	---	SEE E-2 IN ELECTRICAL PARTS	
3	7A43576A01	SUPPORT, motor: rubber.....	.15
4	49B43791A01	FLYWHEEL & SHAFT ASSEM.....	9.25
5	43A43867A01	BEARING, nylon: flywheel assem.....................	.05
6	26A40607B01	RETAINER, actuating arm....	.05
7	3S132645	SCREW, tpg: #4-40 x 7/32 (to secure actuating arm).	.03
8	3S122820	SCREW, tpg: 4-40 x 5/8 (micro sw mtg)...........	.03
9	3S122820	SCREW, tpg: 4-40 x 5/8 (micro sw mtg)...........	.03
10	---	SEE E-6 IN ELECTRICAL PARTS	
11	45A40480B01	ARM, motor actuating.......	.25
13	3K564805	SCREW, spcl: trans mtg.....	.03
14	3K564805	SCREW, spcl: trans mtg.....	.03
15	---	SEE Q-11 IN ELECTRICAL PARTS	
16	14A543810	INSULATOR, trans...........	.10
19	9K561755	SOCKET, trans..............	.25

Ref. No.	Part Number	Description	List Price
21	22C42038A05	PIN, drive: cartridge tension spring (in some sets)......................	.05
22	49A41281B01	ROLLER, spring: metal; drilled (cartridge tension spring - in some sets)....	.20
	49A43658A01	ROLLER, spring: metal; solid (cartridge tension spring - in some sets)....	.15
23	22A43573A01	PIN, transfer: .288-.292 (stereo hd)...............	.55
25	41P40059A48	SPRING, ROLLER & PIN ASSEM cartridge tension.........	.35
28	---	SEE E-3 IN ELECTRICAL PARTS	
32	84D43709A03	BOARD, plated: pre-amp; less all components...........	1.75
37	41A43742A01	SPRING, plunger return.....	.10
38	47P40059A24	PLUNGER, BRKT & ACTUATOR ASSEM.....................	3.00
39	45B43929A01	CAM & RATCHET ASSEM........	1.95
40	43K471633	BEARING, ball: 3/32........	.01
41	47A40181B01	PLUNGER, cam tension.......	.35
42	41A40180B01	SPRING.....................	.05
53	49A43659A03	ROLLER, deck slide: plastic	.25
54	22B43667A03	PIN, spiral: deck slide roller....................	.05
58	15P40059A28	CAPSTAN HSG ASSEM..........	3.00
59	22C42038A02	PIN, drive: flywheel ret...	.05
60	41B43609A03	SPRING, head bracket mtg...	.25
62	3T43787A01	SCREW, spcl: #4-40 x 1/4 (height adjust)...........	.25
63	43K471633	BEARING, ball: 3/32........	.01
64	2S7041	NUT, hex: 2-56 x 3/16 (to secure stereo hd).........	.03
65	7B43531A01	BRACKET, tape guide........	.20
66	46B40913B01	STOP, tape; nylon: tape guide brkt................	.40
67	---	SEE E-4 IN ELECTRICAL PARTS	
71	---	SEE E-1 IN ELECTRICAL PARTS	
72	3S135441	SCREW, mach: 2-56 x 1/4 (to secure stereo hd).....	.05
73	41A40180B01	SPRING.....................	.05
75	3T43787A02	SCREW, spcl: #4-40 x 5/8 (azimuth adjust)..........	.85
76	43K471633	BEARING, ball: 3/32........	.01
77	41A43778A01	SPRING, conical: head adjust screw......................	.10
78	3S6961	SCREW, mach: 4-40 x 3/4 (hd tension adjust).......	.03
79	---	SEE E-8 IN ELECTRICAL PARTS	
81	26B43657A01	SHIELD, motor mtg..........	1.70
85	42B43871A01	BELT, drive................	.75
		ACCESSORY SERVICE AIDS AND TOOLS	
	99P43309A01	CARTRIDGE, test tape.......	17.40
	68P40059A33	DISC, strobe (flywheel)....	
	11P40059A53	GLYPTAL (for cementing adjustment screws)........	
	11M490487	GREASE, silicon............	2.30
	11P40059A55	GREASE, special, light-weight low temperature type.......................	
	66P40059A32	WRENCH, 1/16" Allen head (for azimuth & height adjustment)..............	2.50

MODELS M117RC, M118RC, M119RC

MOTOROLA service manual

GENERAL INFORMATION

This supplement lists parts that are unique to the M117RC, M118RC and M119RC record changers. For all other service and parts information, refer to the M101RC and M102RC service manual.

MODEL BREAKDOWN CHART

RECORD CHANGER		Original Stylus Part No.	Original Cartridge Part No. (Stylus incl)	Diamond LP Stylus Part No. (Not Supplied As Original Equip)
Model	Part No.			
M117RC	59E62782A04	92-150SS	59C62954A01	92-150DS
M118RC	59E62782A05	92-150SS	59C62954A01	92-150DS
M119RC	59E62782A03	92-150SS	59C62954A01	92-150DS

REPLACEMENT PARTS LIST

Ref. No.	Part Number	Description
Listed below are the unique replacement parts for the M117RC, M118RC & M119RC. For all other information refer to the M101RC & M102RC Service Manual.		
12	*36P60015A83	KNOB, control
15	*15P60015A84	LEVER HSG ASSEM: LH; incl insert
29	---	PART OF ITEM 30
30	*49P60015A88	TURNTABLE: incl mat (M117RC)
	*49P60015A89	TURNTABLE: incl mat (M118RC)
	*49P60015A90	TURNTABLE: incl mat (M119RC)
40	*45P60015A82	TONE ARM ASSEM
54	*45P60015A85	RECORD HOLD DOWN ARM
59	*15P60015A86	LEVER HSG ASSEM: RH; incl insert
117	*47P60015A87	REST POST

*DENOTES NEW ITEM APPEARING IN ANY LIST FOR FIRST TIME.

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PART NO. 68P60072A59 4-67 PRICE 10 CENTS

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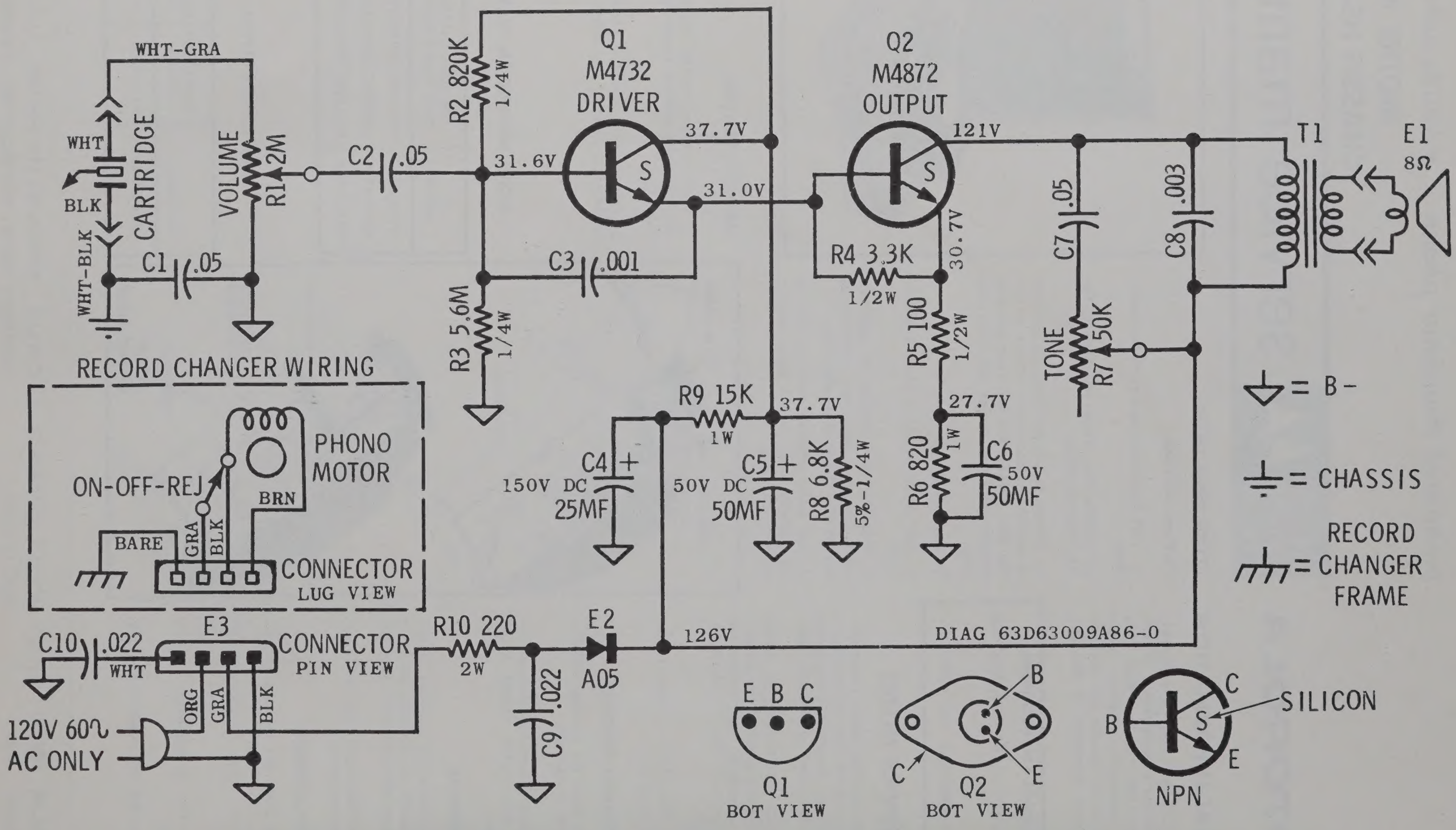
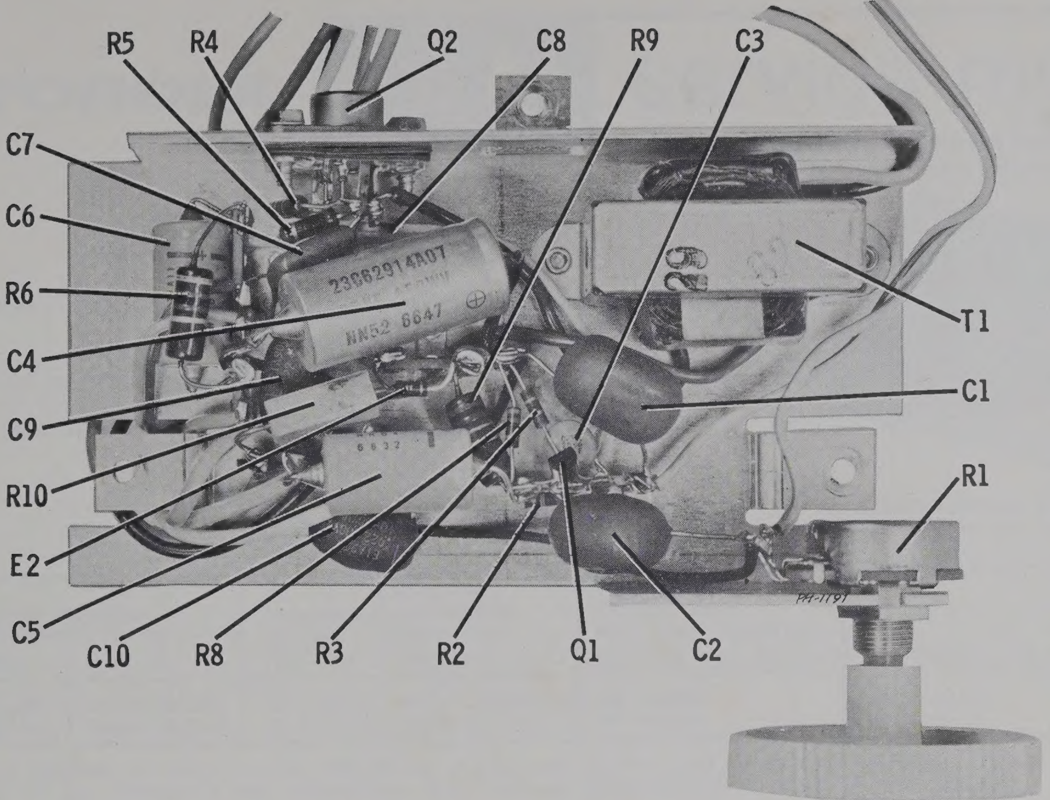

WHT-GRA
WHT
BLK
WHT-BLK
CARTRIDGE
VOLUME
R1 2M
C1 .05
C2 .05
R2 820K 1/4W
R3 5.6M 1/4W
C3 .001
Q1
M4732
DRIVER
31.6V
37.7V
31.0V
Q2
M4872
OUTPUT
121V
30.7V
R4 3.3K 1/2W
R5 100 1/2W
27.7V
R6 820 1W
C6 50V 50MF
C7 .05
C8 .003
TONE
R7 50K
T1
E1
8Ω
R9 15K 1W
37.7V
C4 150V DC 25MF
C5 50V DC 50MF
R8 6.8K 5%-1/4W
RECORD CHANGER WIRING
PHONO
MOTOR
ON-OFF-REJ
BRN
BARE
GRA
BLK
CONNECTOR
LUG VIEW
C10 .022
WHT
E3
CONNECTOR
PIN VIEW
ORG
GRA
BLK
120V 60~
AC ONLY
R10 220 2W
C9 .022
E2
A05
126V
DIAG 63D63009A86-0
= B-
= CHASSIS
= RECORD CHANGER FRAME
E B C
Q1
BOT VIEW
B
C
E
Q2
BOT VIEW
B
C
S
E
SILICON
NPN

SCHEMATIC DIAGRAM



PARTS LOCATION

REPLACEMENT PARTS LIST

Ref. No.	Part Number	Description
		ELECTRICAL PARTS
CAPACITORS - NOTE: The capacitors in this list are recommended replacement types for the original equipment; all are ceramic disc type unless otherwise specified.		
C-1	8S131900	.05 mf 20% 400V mylar (USE 8R128690)
C-2	8G10246A29	.05 mf 20% 125V mylar
C-3	21S410127	.001 mf 20% 500V (USE 21R128045)
C-4	23C62914A07	25 mf 150V lytic
C-5	23C62914A11	50 mf 50V lytic
C-6	23C62914A11	50 mf 50V lytic
C-7	8G10246A29	.05 mf 20% 125V mylar
C-8	21S127855	.0033 mf 10% 500V (USE 21K746523)
C-9	8S132423	.022 mf 20% 400V mylar (USE 8K131588)
C-10	8S132423	.022 mf 20% 400V mylar (USE 8K131588)
MISCELLANEOUS ELECTRICAL PARTS		
E-2	48C191A05	RECTIFIER, silicon
E-3	28A647033	PLUG, 4-cond: less contacts
CONTROLS		
R-1	18D62999A25	CONTROL, loudness
R-7	18D62999A24	CONTROL, tone
TRANSFORMERS		
T-1	25C63207A02	OUTPUT
TRANSISTORS		
Q-1	48S134732	M4732
Q-2	48S134872	M4872
		MECHANICAL PARTS
	39A749927	CONTACT, plug: use w/28A647033 plug
	30S189A01	CORD, line
	14A63948A01	INSULATOR, trans
	29A64778A01	LUG, term: spkr leads
	29K636476	LUG, term: transf leads
	2S7051	NUT, stamped: cont mtg
	9B63949A01	SOCKET, trans
		CABINET PARTS
	7A61215A03	BRACKET, spkr mtg
	*16E60798B01	CABINET ASSEM: incl base, cover & spkr contacts; less spkr grille & insert overlay
	*13E60428B02	GRILLE, spkr: blu (MP102CL)
	*13E60428B03	GRILLE, spkr: brn (MP102CN)
	*13E60428B01	GRILLE, spkr: red (MP102CR)
	*36C60473B01	KNOB, vol & tone
	29K534326	LUG, term: spkr leads
	*13D60257B02	OVERLAY, knob: blu (MP102CL)
	*13D60257B03	OVERLAY, knob: brn (MP102CN)
	*13D60257B01	OVERLAY, knob: red (MP102CR)
	*13A60483B01	OVERLAY, insert:"Motorola" (cab cover)
	3S136070	SCREW, tpg: #4-24 x 3/8 (knob overlay)
	*3S135986	SCREW, tpg: #6-18 x 1/2 (spkr grille mtg)
	*3S135918	SCREW, tpg: #6-18 x 1 (chgr mtg)
	3S122335	SCREW, tpg: #6-20 x 1/2 (spkr mtg)
	50D60445B01	SPEAKER, 4 PM
	47B63772A02	SPINDLE, 45 RPM

*DENOTES NEW ITEM APPEARING IN ANY LIST FOR FIRST TIME.

SUPPLEMENT NO. 1
TO PART NO. 68P63010A88

record changer

MANUAL 68P63010A89

MODELS M115RC, M116RC

MOTOROLA service manual

MODELS M115RC & M116RC

GENERAL INFORMATION

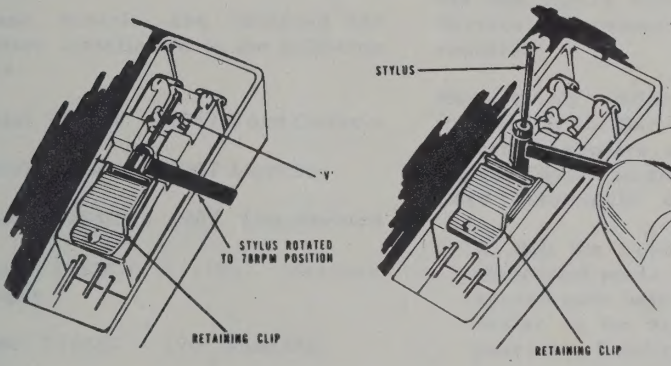
This supplement covers the following:

1. Introduction of the two added changers which are mechanically the same as the M114RC.
2. A revised cartridge and stylus for the two changers, M115RC and M116RC.
3. Listed below is model with cartridge and stylus changes.

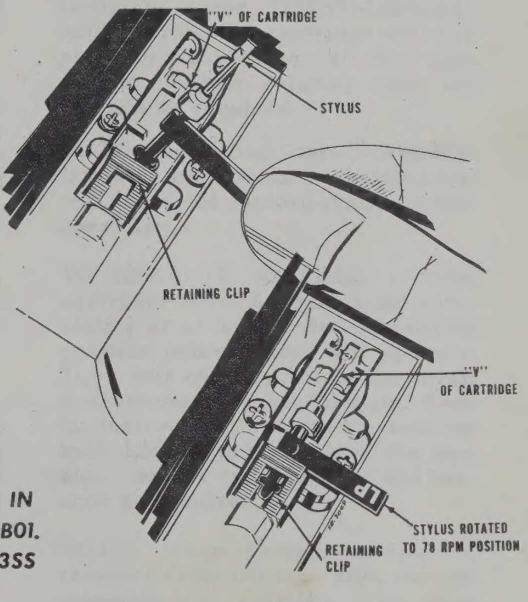
MODEL BREAKDOWN CHART

RECORD CHANGER		Original Stylus Part No.	Original Cartridge Part No. (Stylus incl)	Diamond LP Stylus Part No. (Not Supplied As Original Equip)	Cartridge Illustrated
Model	Part No.				
*M115RC	59E60122B03	92-148SS	59C61496A01	92-148DS	See below
M116RC	59E60122B04	92-813SS	59C60459B01	92-813DS	See below

*When M115RC is used in the PP205C-1 Model use above cartridge Part Number. When used in the PP205C-2 use cartridge Part Number 59C60459B01. Same as the M116RC.



M115RC USED IN PP205C-1. CARTRIDGE 59C61496A01. STYLUS 92-148SS



M115RC & M116RC USED IN
PP205C-2-PP206C-2. CARTRIDGE 59C60459B01.
STYLUS 92-813SS

REPLACEMENT PARTS LIST

Ref. No.	Part Number	Description	Ref. No.	Part Number	Description
Parts listed below are unique to the M115RC and M116RC. For complete parts list refer to M114RC Manual.			62	*59C60459B01	CARTRIDGE, phono: incl stylus (M116RC)
				92-148SS	STYLUS: sapph-sapph (M115RC)
				92-148DS	STYLUS: dia-sapph (M115RC)
40	*45P63027A96	TONE ARM ASSEM (M115RC)		*92-813SS	STYLUS: sapph-sapph (M116RC)
40	*45P63027A99	TONE ARM ASSEM (M116RC)		*92-813DS	STYLUS: dia-sapph (M116RC)
42	*30P63027A68	CABLE ASSEM: tone arm (M115RC)	63	*3P63027A98	SCREW, cartridge mtg (M115RC)
42	30P63027A53	CABLE ASSEM: tone arm (M116RC)	63	3P63020A44	SCREW, cartridge mtg (M116RC)
62	59C61496A01	CARTRIDGE, phono: incl stylus (M115RC)			

*DENOTES NEW ITEM APPEARING IN ANY LIST FOR FIRST TIME.

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PART NO. 68P63010A89 1-67 PRICE 10 CENTS

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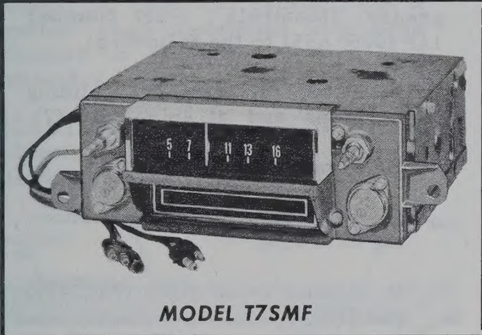
stereosonic tape player & am radio combination MANUAL 68P43100A84

MOTOROLA T7SMF
T7SMM
T7SMS
T7SMW
T7SMZ

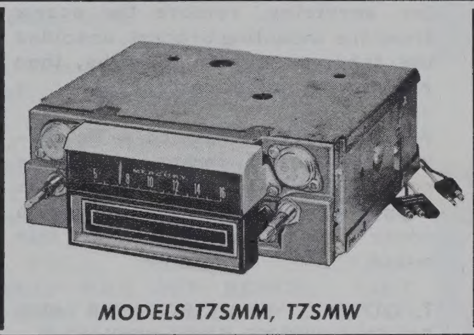
FORD C7AA-18806-H
C7MA-18806-J
C7SA-18806-N
C7WA-18806-A
C7ZA-18806-C

MOTOROLA

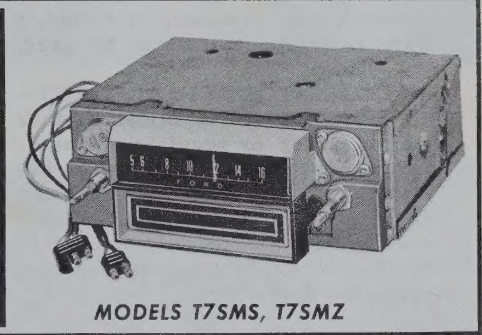
service manual



MODEL T7SMF



MODELS T7SMM, T7SMW



MODELS T7SMS, T7SMZ

GENERAL INFORMATION

These models are designed for custom installation in the following cars:

Model T7SMF - 1967 Ford Galaxie

Model T7SMM - 1967 Mercury

Model T7SMS - 1967 Thunderbird

Model T7SMW - 1967 Mercury Cougar

Model T7SMZ - 1967 Mustang

SERVICE STATION PROCEDURE

This model or any other automotive type radio previously manufactured by Motorola for the Ford Motor Company is not covered by the Motorola Auto Radio Guarantee Plan because Ford Motor Company itself carries the guarantee.

Motorola Guarantee Labor Claim Form is not to be used for a Ford radio repair, nor is it or defective parts for repair to be directed to Motorola, Inc. or their authorized distributors.

The Ford Dealer may perform guarantee repairs himself if he is adequately equipped.

If the Ford Dealer is not equipped, he may contact a Service Station of his own choice with whom he has a Service Agreement for guarantee repairs.

Here is an outline which may be followed by the Service Station when guarantee repairs are required by a Ford Dealer on any Motorola built Ford automobile or truck radio:

A. Bill the Ford Dealer for replacement parts and for labor as agreed upon between you and the dealer in the repair of the in-guarantee Ford receiver.

B. The model and serial number of each receiver, the description of repair, the Motorola or Ford number of the parts replaced should appear on your invoice to the dealer.

C. All defective parts should be returned to the Ford Dealer. THIS IS IMPORTANT AND NECESSARY so that he may receive his adjustment from the Ford factory.

OPERATING INSTRUCTIONS

OPERATION

TO PLAY TAPES - Turn unit on by rotating the on-off and volume control to the right. Select a tape cartridge and insert it - label side up and open end first - into the tape slot. Push the cartridge in until it is firmly seated. (THIS IS IMPORTANT.) The tape cartridge will now play, in succession, all four programs. Adjust volume, tone and balance as required.

NOTE: Inserting tape cartridge into slot automatically switches this unit from AM radio operation to tape operation.

TO OPERATE AM RADIO - Tape cartridge must be pulled out completely or at least 1" from its seated position before radio will operate. Turn unit on by rotating the on-off and volume control to the right. Tune in desired station with the smaller knob located to the right of the tape slot. Adjust volume, tone and balance as required.

NOTE: When the tape cartridge is removed from the tape slot, the unit automatically switches from tape operation to AM radio operation.

CAUTION: The tape cartridge should always be pulled out completely or approximately 1" from the seated (play) position before leaving car or turning unit off.

TAPE CARTRIDGE CARE

To assure maximum life and noise free operation, tapes should be stored in a cool, clean and dry place, out of the rays of the sun and with the open (tape) end down.

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PART NO. 68P43100A84 2-67 PRICE 50 CENTS COPYRIGHT 1967 BY MOTOROLA INC. - PRINTED IN U.S.A.

SERVICE NOTES

1. RADIO POLARITY - WHEN SERVICING THIS RECEIVER, THE "A" LEAD MUST BE CONNECTED TO THE POSITIVE SIDE OF POWER SOURCE. IF CONNECTED OTHERWISE, RECEIVER WILL NOT OPERATE AND DAMAGE TO COMPONENTS MAY RESULT.

2. POWER SUPPLY REQUIREMENTS - It is preferable to use a storage battery (without a battery charger) in place of a battery eliminator. If a battery eliminator is used, it must be well filtered and regulated.

3. OUTPUT LOAD - Always operate this receiver with an output load across each of the two channels; either 8 ohm speakers or 8 ohm, 5 watt resistive loads can be used.

4. TRANSISTOR REPLACEMENT - When replacing a transistor other than a power or regulator transistor, grasp the transistor leads between transistor body and plated chassis board with a pair of long nose pliers to prevent excessive heating of transistor body during soldering operation.

5. POWER AND REGULATOR TRANSISTOR REPLACEMENT - When replacing a power or regulator transistor, be sure to:

A. Use the transistor specified in the Replacement Parts List.

B. Coat both sides of transistor insulator with DC-4 grease (Motorola Part No. 11M490487) to insure proper heat dissipation.

C. Securely and evenly tighten the transistor mounting screws.

6. GAINING ACCESS TO THE PLATED BOARDS - Remove top and bottom covers and refer to photo.

Tape Pre-Amp Plated Board - To remove this board for servicing, merely unsolder the chassis ground lead, bend the copper retaining clip and lift up the chassis to a more serviceable position.

Audio Amplifier Plated Board - To gain access to the bottom side of this board, remove the two (2) screws at the front side of the radio (see photo). To remove the board for servicing, remove the screw from the mounting bracket, unsolder the tabs, straighten the tabs, then remove the mounting bracket.

AM Radio Plated Board - To service this board, remove the 5 side cover mounting screws, bend the copper retaining clip so that the side cover can be removed from this board.

7. OUTPUT TRANSFORMER AND FILTER CHOKE REPLACEMENT - Remove the two (2) screws at the front side of the radio (see photo) and pull out wraparound far enough so that transformer or filter choke can be removed.

8. FLYWHEEL AND CAPSTAN REMOVAL:

A. Loosen phillips head screw 1-1/2 turns out from capstan flywheel assembly. Tap on screw head gently to release flywheel from capstan shaft.

B. With flywheel removed, grasp tru-arc washer with pliers and remove.

C. To remove capstan shaft, pull shaft up and out of housing. Observe how race bearing is inserted so as to replace on new capstan in the same manner.

9. LUBRICATION - This unit is lubricated at the factory and should not require additional attention unless the suspected parts are replaced or bind.

Apply a lightweight, low temperature grease (Motorola Part Number 11P40059A55) to the following:

A. Pawls (6) and (17) on sliding surfaces and at spiral pin (7).

B. Cam shaft (26).

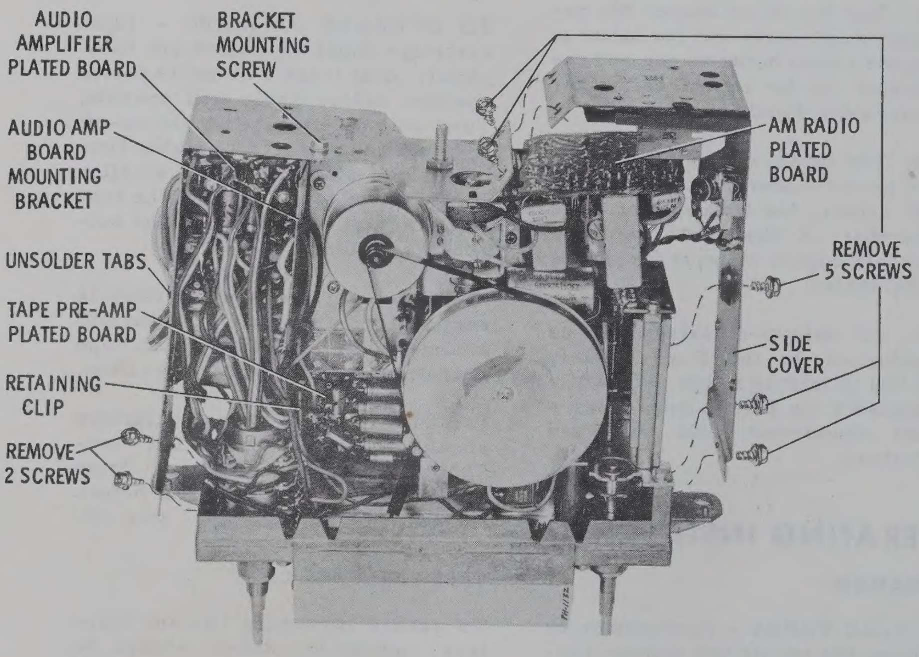
C. Step surface of head positioning cam (95).

D. Radius arms (68), (70), (77) and (78).

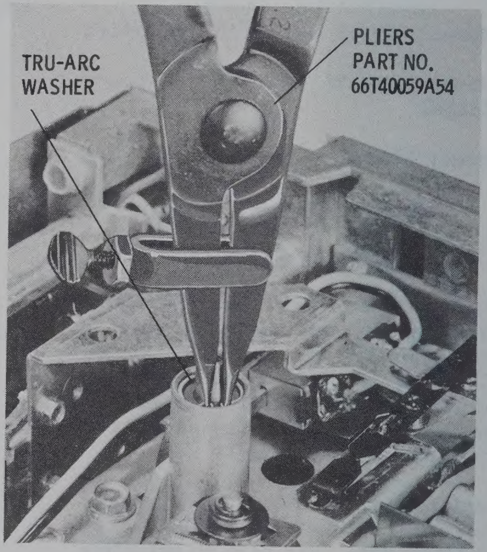
Silicon grease (Motorola Part No. 11M490487) should be applied to capstan bearing (52).

NOTE: DO NOT GREASE SOLENOID PLUNGER (16).

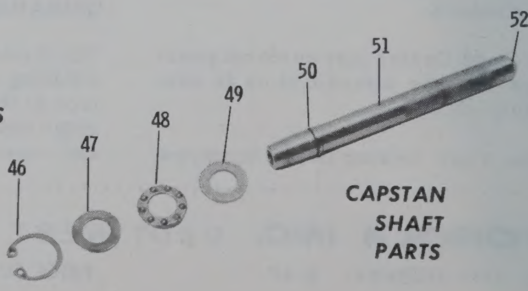
10. TAPE CARTRIDGES - Before servicing the tape player portion of



GAINING ACCESS TO PLATED BOARDS, FILTER CHOKE AND TRANSFORMERS



FLYWHEEL & CAPSTAN REMOVAL

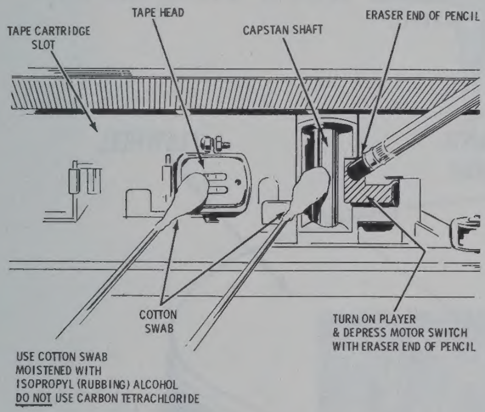


CAPSTAN SHAFT PARTS

this unit, always check for the possibility of a defective pre-recorded tape cartridge, particularily if one is returned with the unit. This should be done by substituting the tape cartridge with one that is known to be good.

11. TAPE HEAD AND CAPSTAN CLEANING - One major cause of improper tape player operation is oxide build-up on the head and capstan. During normal operation, some iron oxide particules are loosened from the tape and build up. This accumulation of oxide can cause poor playback and up and down tape travel. The head and capstan should be cleaned whenever the unit is serviced and this can be done either in the car or on the service bench. To clean the head and capstan, use a cotton swab moistened with head cleaner or isopropyl alcohol, then wipe dry.

(CAUTION should be exercised when cleaning playback head to prevent getting cleaner on any plastic parts.)


TAPE CARTRIDGE SLOT
TAPE HEAD
CAPSTAN SHAFT
ERASER END OF PENCIL
COTTON SWAB
TURN ON PLAYER & DEPRESS MOTOR SWITCH WITH ERASER END OF PENCIL
USE COTTON SWAB MOISTENED WITH ISOPROPYL (RUBBING) ALCOHOL
DO NOT USE CARBON TETRACHLORIDE

TAPE HEAD & CAPSTAN CLEANING

12. HEAD DEMAGNETIZING - Do not use magnetized screwdrivers and wrenches near the head since these can magnetize the head. The head may also, after a long period of time, acquire some residual magnetism. A head that is magnetized will show a definite loss of high frequency response and an increase in noise level. Use a commerically available head demagnetizer following instructions included with the unit to demagnetize the head.

ADJUSTMENTS

Head adjustments are normally required for cases of cross-talk, loss or noisy frequency response or if the head has been replaced.

A suitable test tape should be used for the azimuth and height adjustments. Motorola has a suitable test tape cartridge available for the field under Part Number 99P43309A01. Instructions, in the form of a label on the cartridge, are included.

NOTE: MAKE SURE HEAD HEIGHT AND AZIMUTH ADJUSTMENTS ARE MADE FROM THE BOTTOM.

HEAD HEIGHT ADJUSTMENT

1. Remove bottom cover and turn player upside down. Locate head height adjustment screw assembly (see Figure).

2. With 1/4" open end wrench and screw driver, loosen 1/4" nut one full turn retaining screw driver firmly in slot so that screw does not turn. Turn player right side up.

3. Put loads across each channel and make necessary power supply connections.

4. Connect scope or VTVM across left channel output.

5. Insert tape test cartridge into tape slot and position head to tracks #2 and #6. Set balance control for maximum output from left channel.

6. PULL PLAYER FORWARD HALF-WAY OFF BENCH. LIFT FRONT OF PLAYER 30° - 45° SO THAT HEIGHT ADJUSTMENT SCREW IS ACCESSIBLE. WITH SMALL SCREWDRIVER, ADJUST FOR NULL.

7. Hold screw driver into slot and while firmly holding screw in place, tighten lock nut and apply glyptal.

AZIMUTH ADJUSTMENT

1. Connect scope or VTVM across the output of the right channel and adjust balance control for maximum right channel output.

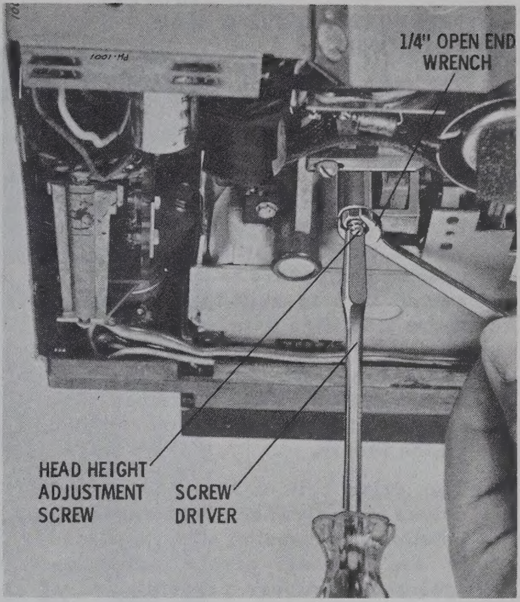
2. PULL PLAYER FORWARD HALF-WAY OFF BENCH AND LIFT 30° - 45° AND ADJUST AZIMUTH SCREW FOR MAXIMUM OUTPUT ON SCOPE OR VTVM (SEE FIGURE). MISADJUSTMENT OF THIS SCREW WOULD CAUSE POOR HIGH FREQUENCY RESPONSE.

INDEXING SOLENOID ADJUSTMENT

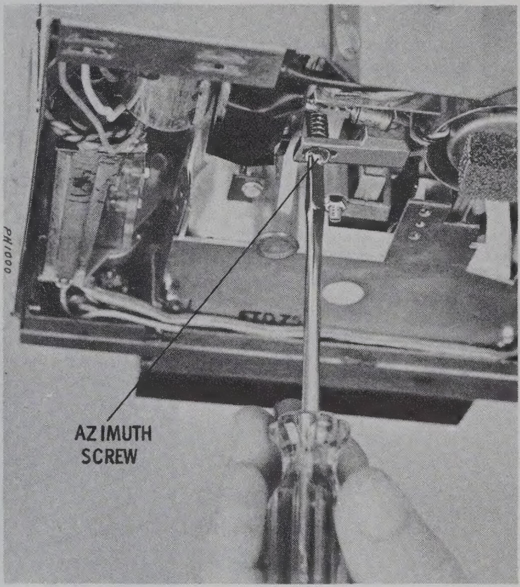
1. Insert cartridge into player and adjust power supply to eleven volts.

2. Insert a screwdriver into the solenoid adjustment screw. Turn the adjustment screw into the coil, at the same time indexing the player (see Figure). Continue to index and turn the screw into the coil to the point where the solenoid just fails to index the player.

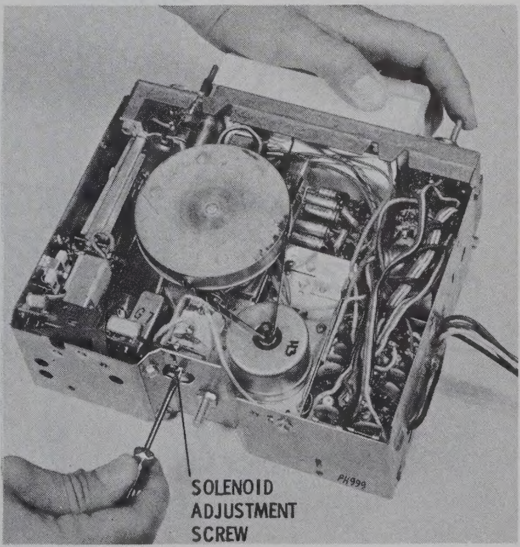
3. Back the screw out from the coil to where the player will properly index. Lock the retaining nut at this point and apply glyptal.



HEAD HEIGHT ADJUSTMENT



AZIMUTH ADJUSTMENT



INDEXING SOLENOID ADJUSTMENT

TAPE PLAYER DRIVE & HEAD POSITIONING

The view shown below is one looking into the tape player from the front with a tape cartridge inserted and operating.

When the tape cartridge is inserted into the tape slot and with the unit turned on, the switch cam is forced upward and pushes in the radio-tape switch arm to shift the input of the audio amplifier from radio circuitry to tape pre-amp circuitry. At the same time, the front of the tape cartridge presses against the micro-switch actuating arm to turn on the motor.

The drive belt on the motor shaft drives the flywheel, causing it to rotate. The capstan shaft, attached to the flywheel presses the tape against the rubber pressure roller (inside the cartridge) and drives the tape. The tape guide bracket keeps the tape from riding up and down the head.

Since the pre-recorded tape has four dual channel programs (8 tracks), the head has to be moved to four different height positions with respect to the tape. The sequence of head movement is as follows:

Tracks #1 and #5.

Tracks #2 and #6

Tracks #3 and #7

Tracks #4 and #8

Tracks #1 and #5 (return to original tracks)

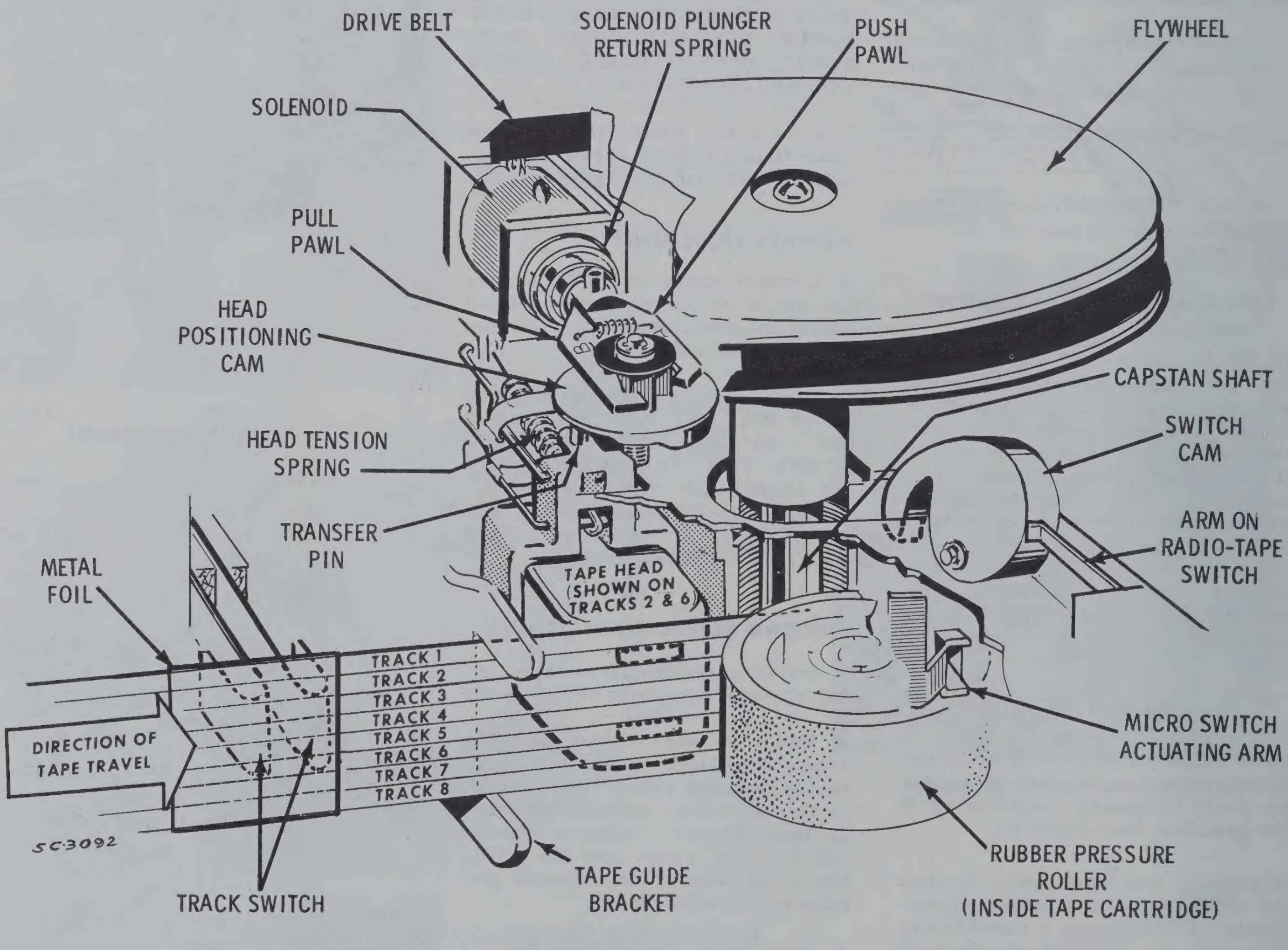
Tracks #1 - #4 are left channel; tracks #5 - #8 are right channel.

The positioning of the head can be accomplished either manually or automatically. Manual positioning is accomplished whenever the channel selector switch (on volume control shaft) is pushed in and released.

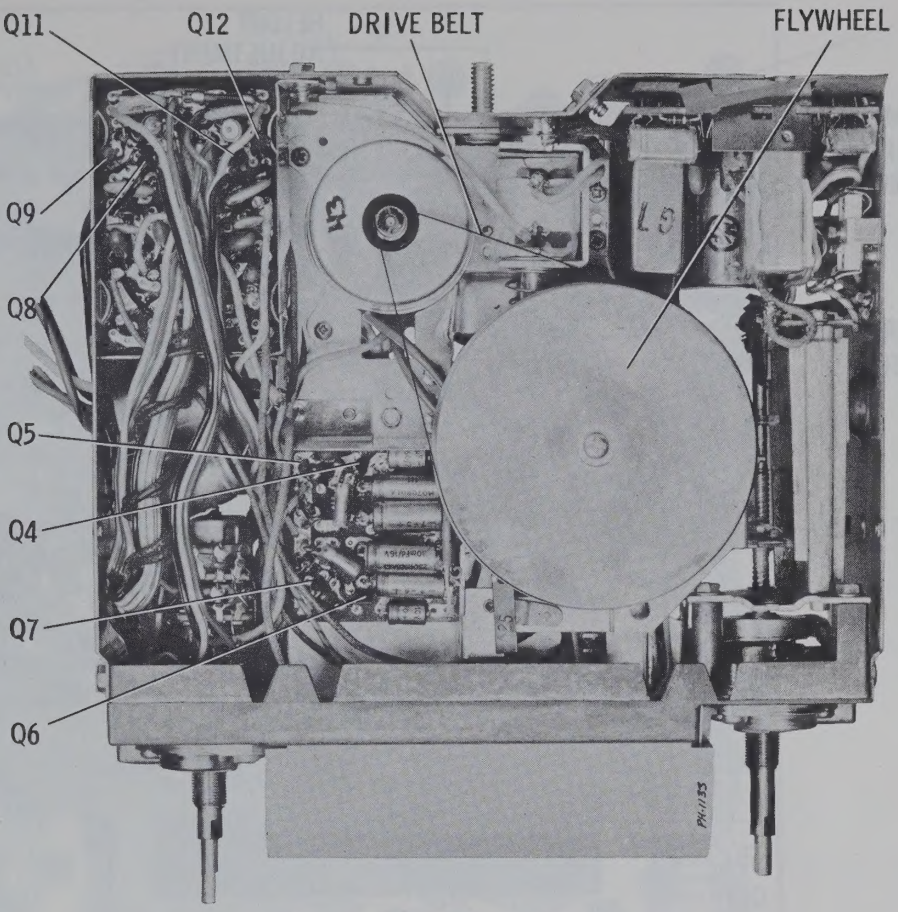
When the selector switch is pushed in, one end of the solenoid is grounded. The resultant magnetic field in the solenoid pulls back the pull pawl teeth against the ratchet portion of the head positioning cam, causing it to rotate through 1/2 of its cycle. When the switch is released, the solenoid current is shut off and the plunger return spring pushes the plunger out of the solenoid.

This causes the teeth on the push pawl to ratchet the cam and complete the second half of its rotation cycle. The head tension spring keeps the transfer pin (part of the head assembly) against the 8 step cam to move the head up or down as the cam rotates.

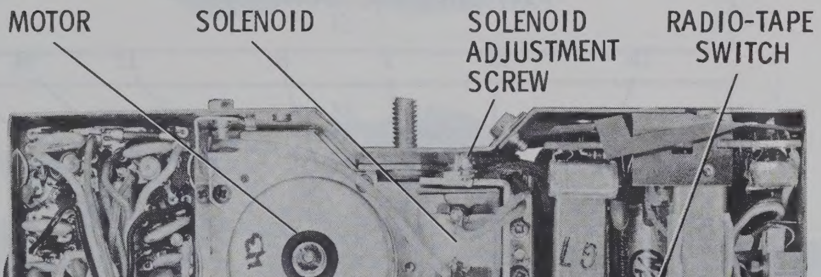
Automatic positioning of the head to the next dual channel program is accomplished by the tape itself when the end of a program is reached. The pre-recorded tape has, at the end of the recorded programs, a strip of metal foil which shorts out the track switch which is in contact with the tape at all times. This switch is wired in parallel with the channel selector switch to start the same action that occurred when the channel selector switch was activated.


DRIVE BELT
SOLENOID PLUNGER RETURN SPRING
PUSH PAWL
FLYWHEEL
SOLENOID
PULL PAWL
HEAD POSITIONING CAM
CAPSTAN SHAFT
SWITCH CAM
HEAD TENSION SPRING
TRANSFER PIN
ARM ON RADIO-TAPE SWITCH
METAL FOIL
TAPE HEAD (SHOWN ON TRACKS 2 & 6)
TRACK 1
TRACK 2
TRACK 3
TRACK 4
TRACK 5
TRACK 6
TRACK 7
TRACK 8
DIRECTION OF TAPE TRAVEL
MICRO SWITCH ACTUATING ARM
SC-3092
TRACK SWITCH
TAPE GUIDE BRACKET
RUBBER PRESSURE ROLLER (INSIDE TAPE CARTRIDGE)

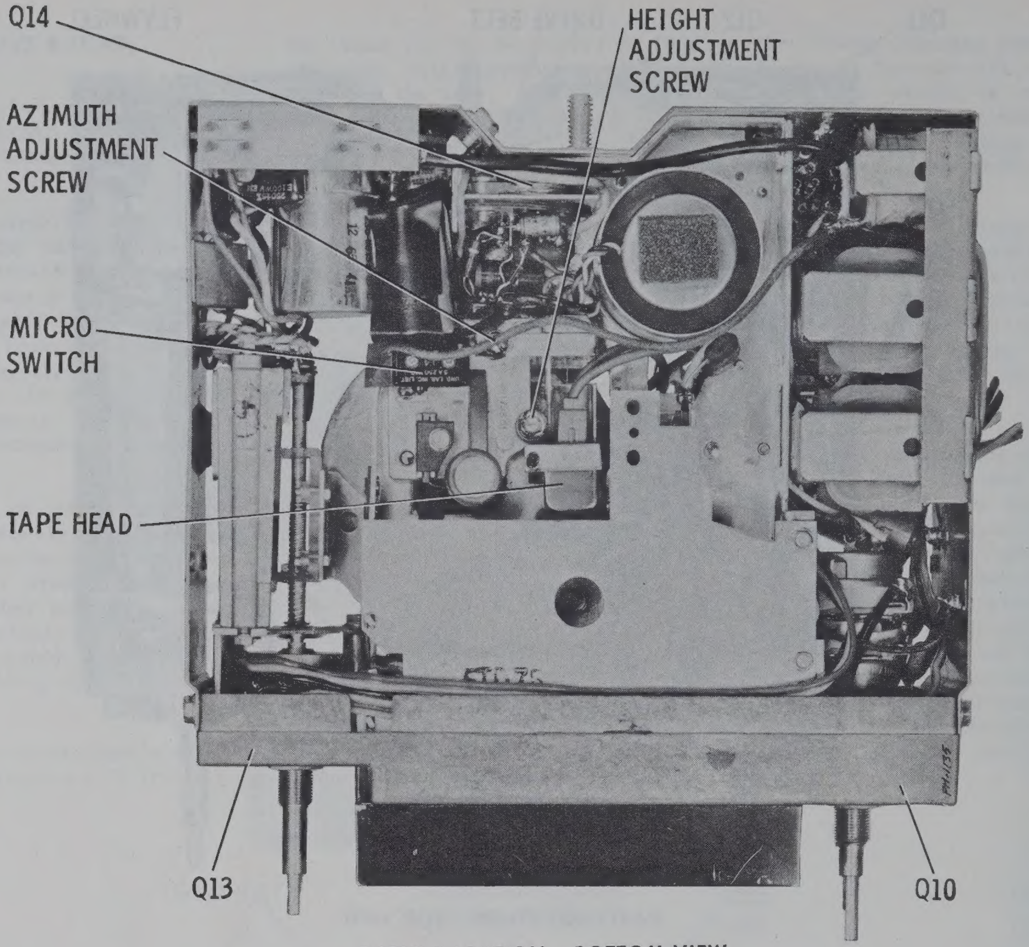
TAPE DRIVE AND HEAD POSITIONING


Q11
Q12
DRIVE BELT
FLYWHEEL
Q9
Q8
Q5
Q4
Q7
Q6
PH-1133

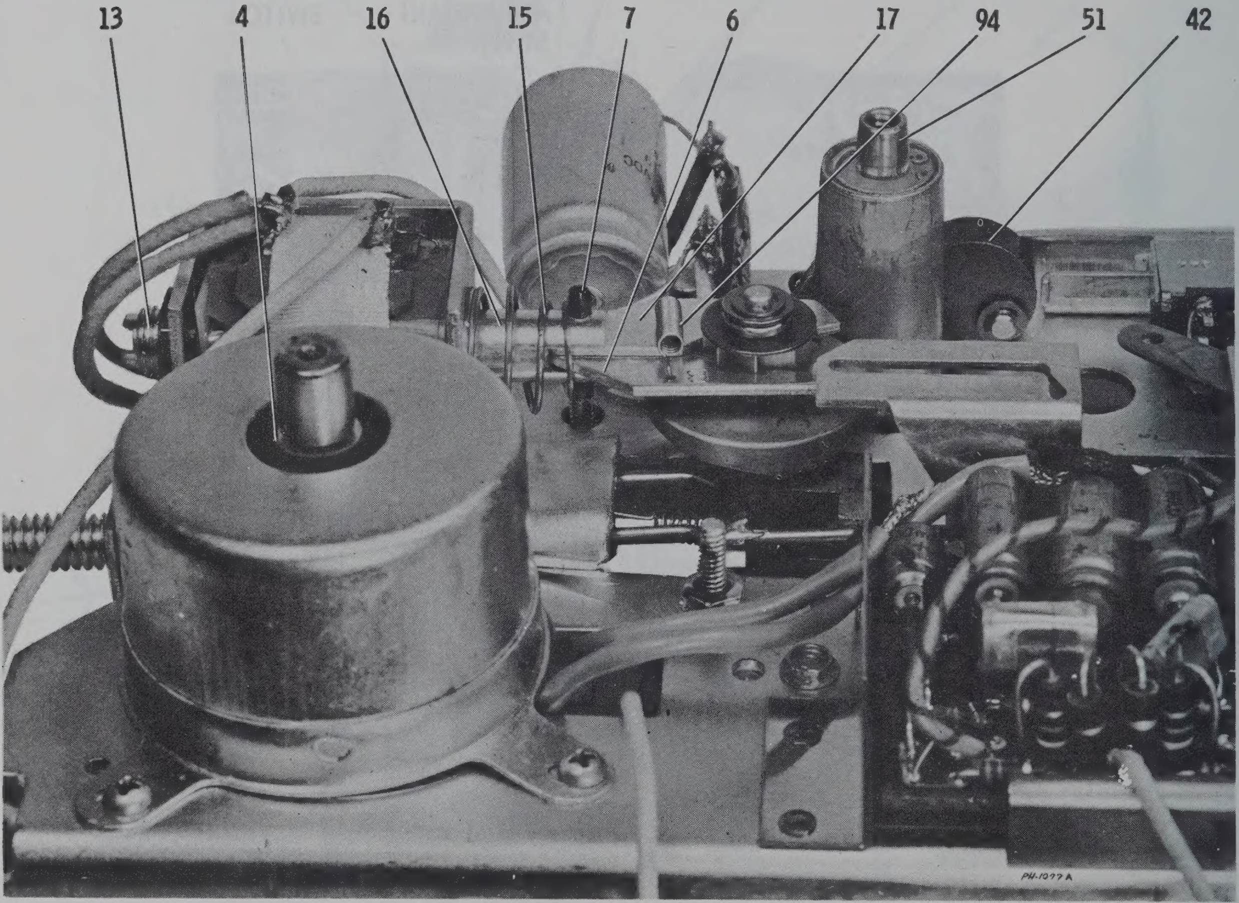
PARTS LOCATION - TOP VIEW


MOTOR
SOLENOID
SOLENOID ADJUSTMENT SCREW
RADIO-TAPE SWITCH
PH-1134

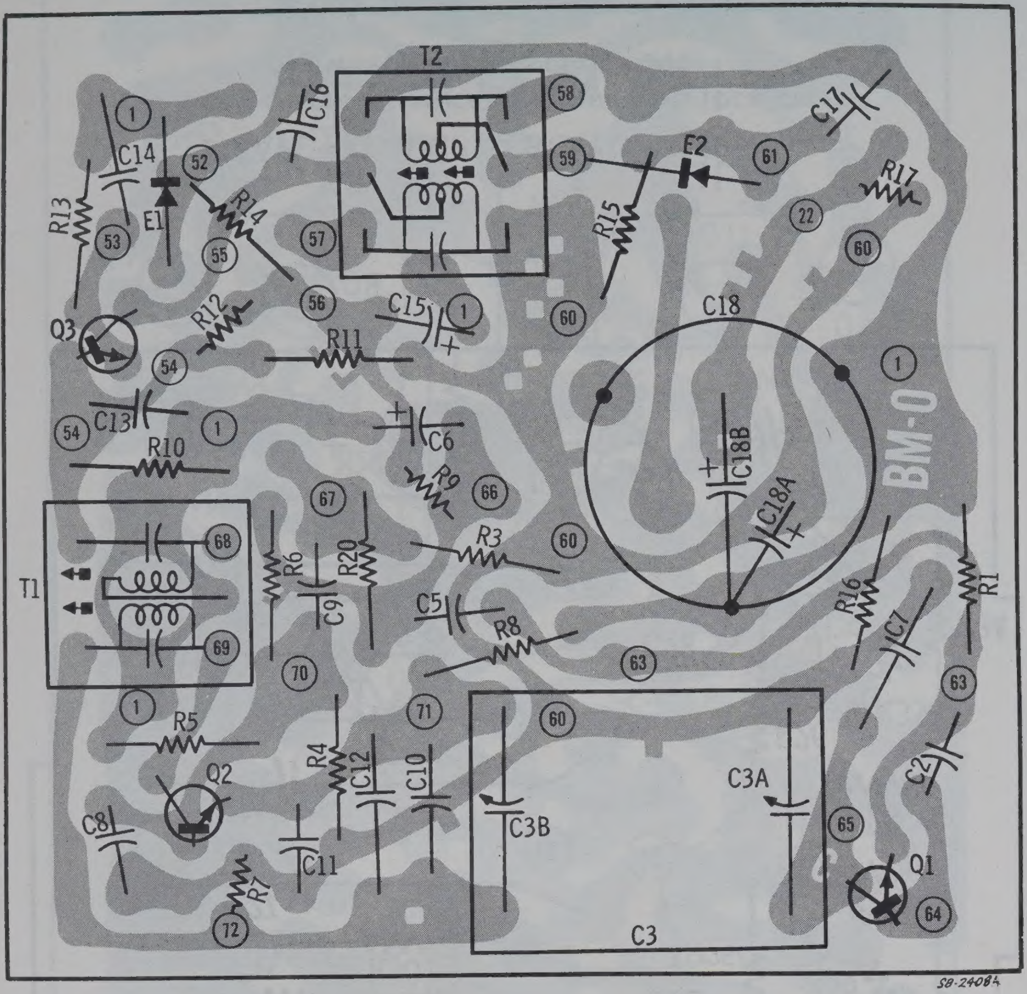
PARTS LOCATION - TOP VIEW WITH FLYWHEEL REMOVED


Q14
AZIMUTH ADJUSTMENT SCREW
HEIGHT ADJUSTMENT SCREW
MICRO SWITCH
TAPE HEAD
Q13
Q10
PH-1135

PARTS LOCATION - BOTTOM VIEW

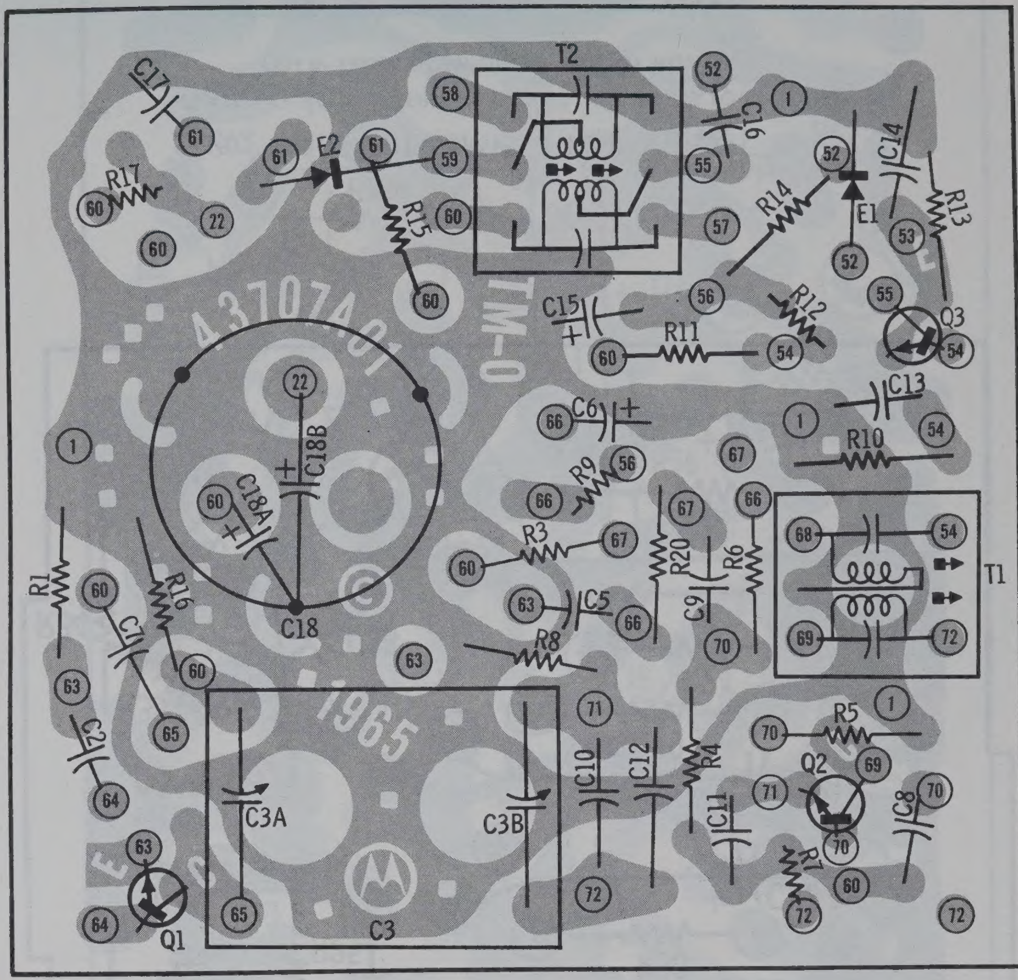

13
4
16
15
7
6
17
94
51
42
PH-1077A

PARTS LOCATION - RATCHET MECHANISM


T2
T1
C3
C3A
C3B
C18
C18A
C18B
BM-0
Q1
Q2
Q3
E1
E2
R1
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
R20
C2
C5
C6
C7
C8
C9
C10
C11
C12
C13
C14
C15
C16
C17
SB-24084

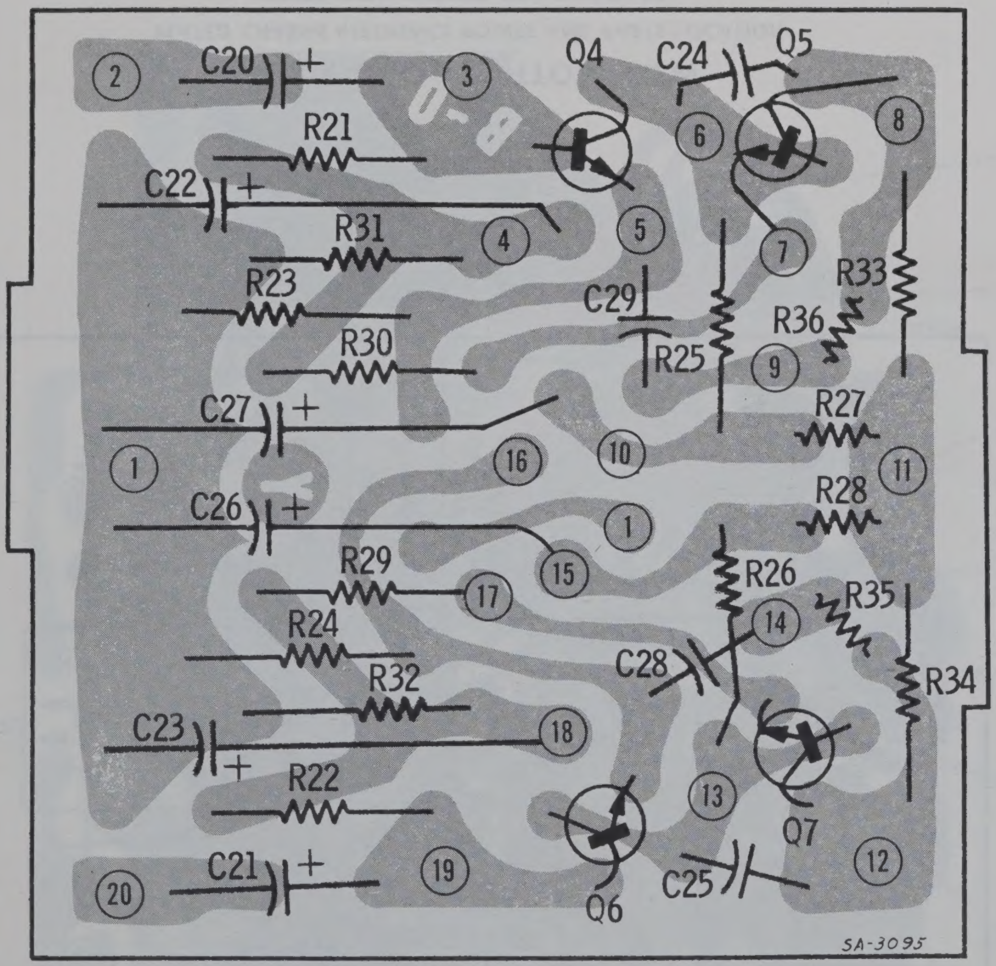
AM RADIO - BOTTOM VIEW

PLATED CHASSIS REFERENCE POINTS AND PARTS LOCATION
(VIEW FROM WIRING SIDE OF BOARD)


T2
T1
C3
C3A
C3B
C18
C18A
C18B
TM-0
43707A01
1965
Q1
Q2
Q3
E1
E2
R1
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
R20
C2
C5
C6
C7
C8
C9
C10
C11
C12
C13
C14
C15
C16
C17

AM RADIO - TOP VIEW

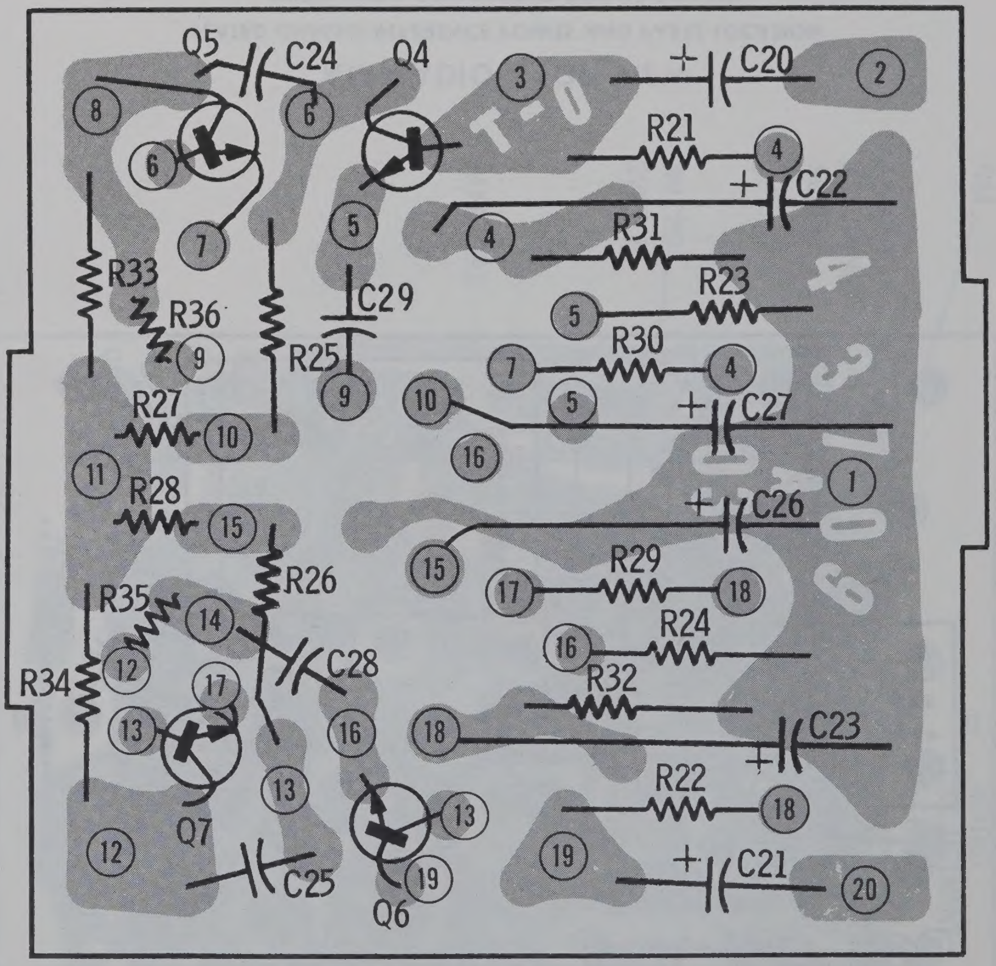
PLATED CHASSIS REFERENCE POINTS AND PARTS LOCATION
(VIEW FROM COMPONENT SIDE OF BOARD)


C20
C21
C22
C23
C24
C25
C26
C27
C28
C29
R21
R22
R23
R24
R25
R26
R27
R28
R29
R30
R31
R32
R33
R34
R35
R36
Q4
Q5
Q6
Q7
B-0
Y
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
SA-3095

TAPE PRE-AMP — BOTTOM VIEW

PLATED CHASSIS REFERENCE POINTS AND PARTS LOCATION

(VIEW FROM WIRING SIDE OF BOARD)


C20
C21
C22
C23
C24
C25
C26
C27
C28
C29
R21
R22
R23
R24
R25
R26
R27
R28
R29
R30
R31
R32
R33
R34
R35
R36
Q4
Q5
Q6
Q7
T-0
4 3 7 0 9
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
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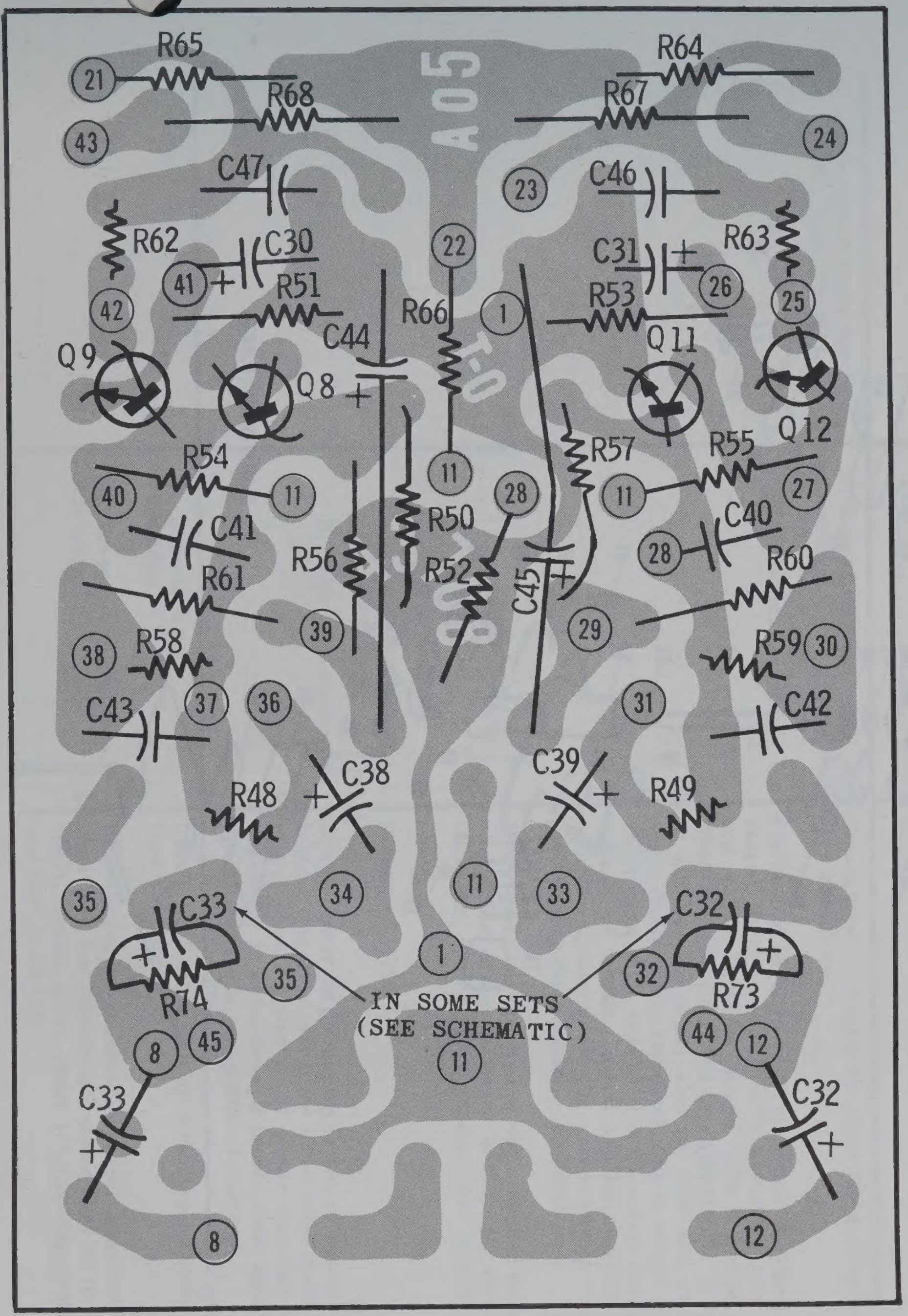
18
19
20

TAPE PRE-AMP — TOP VIEW

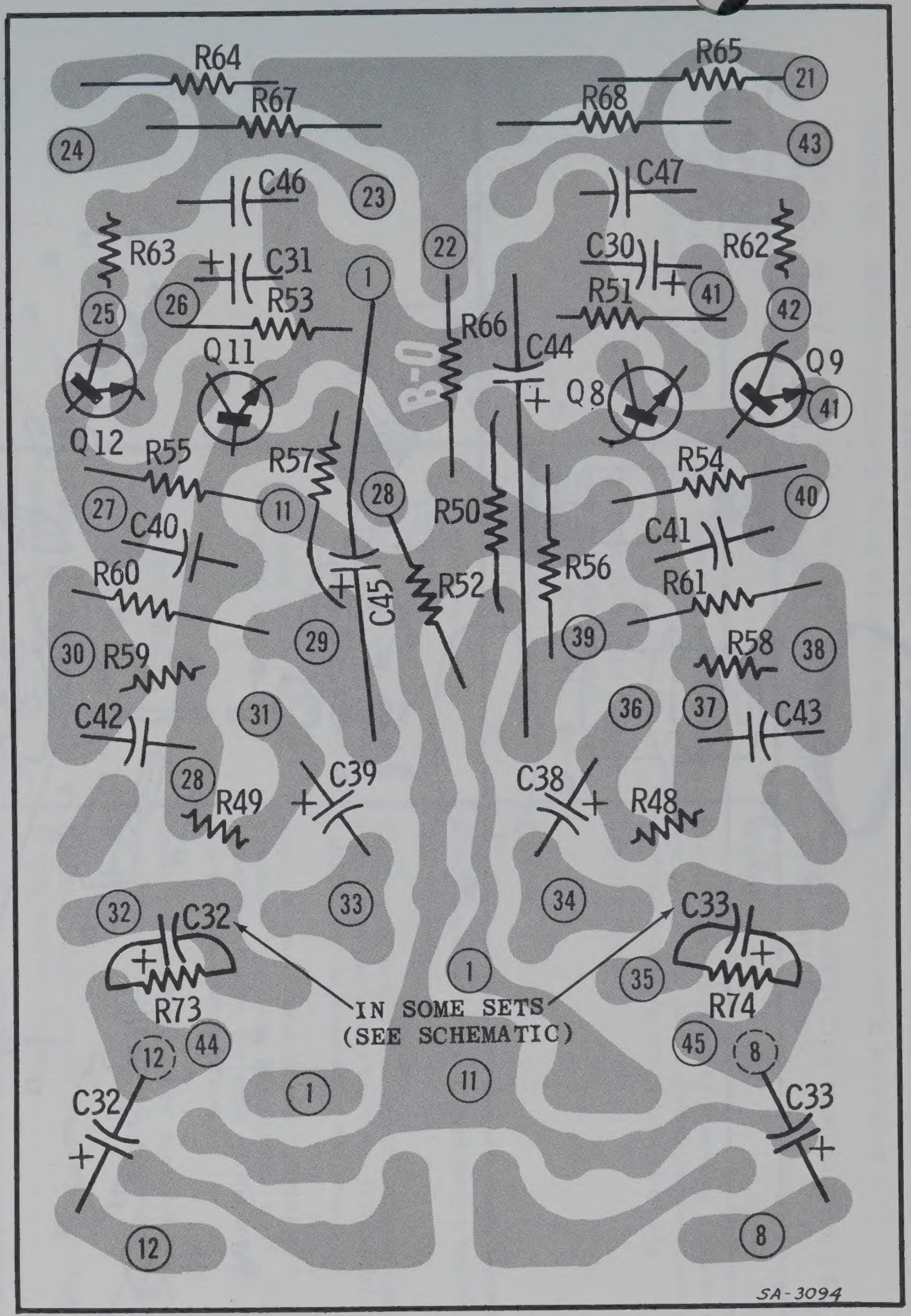
PLATED CHASSIS REFERENCE POINTS AND PARTS LOCATION

(VIEW FROM COMPONENT SIDE OF BOARD)


R65
R68
R64
R67
A05
C47
C46
R62
C30
R51
C44
R66
C31
R53
R63
Q9
Q8
Q11
Q12
R54
R50
R57
R55
C41
R56
R52
C45
C40
R61
R60
R58
R59
C43
C42
C38
C39
R48
R49
C33
R74
C32
R73
IN SOME SETS
(SEE SCHEMATIC)
T-0
21
43
24
23
22
1
26
25
41
42
11
28
27
40
39
29
38
30
37
36
31
34
33
35
32
44
12
45
8

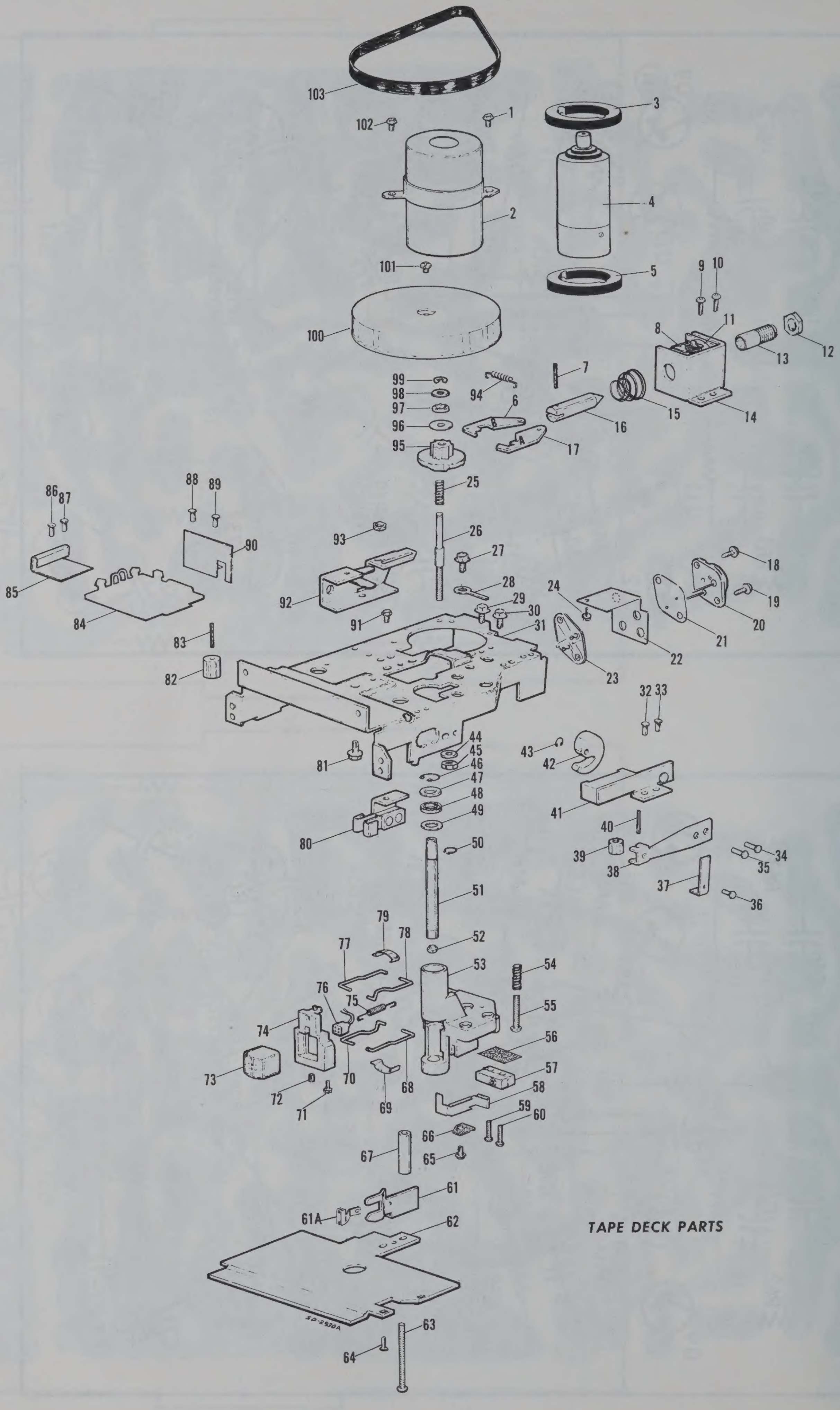
AUDIO AMPLIFIER - TOP VIEW

PLATED CHASSIS REFERENCE POINTS AND PARTS LOCATION
(VIEW FROM COMPONENT SIDE OF BOARD)


R64
R67
R68
R65
C46
C47
R63
C31
R53
C30
R51
R62
Q11
Q12
Q8
Q9
R66
C44
B-0
R55
R57
R50
R54
C40
C45
R52
R56
C41
R60
R61
R59
R58
C42
C43
C39
C38
R49
R48
C32
R73
C33
R74
IN SOME SETS
(SEE SCHEMATIC)
SA-3094
24
21
43
23
22
1
26
25
41
42
27
11
28
40
29
39
30
38
31
36
37
33
34
32
35
44
45
12
8

AUDIO AMPLIFIER - BOTTOM VIEW

PLATED CHASSIS REFERENCE POINTS AND PARTS LOCATION
(VIEW FROM WIRING SIDE OF BOARD)


103
102
1
3
2
4
101
5
9
10
100
8
11
12
13
7
99
94
6
98
97
96
95
16
15
14
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86
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54
76
75
55
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66
67
65
61
61A
62
SD-2930A
63
64

TAPE DECK PARTS

TAPE PLAYER TROUBLESHOOTING CHART

NOTE #1: DO NOT OPERATE TAPE PLAYER UPSIDE DOWN - CARTRIDGE MAY JAM.

NOTE #2: MANY TAPE PLAYER PROBLEMS CAN BE CAUSED BY DEFECTIVE CARTRIDGES; BEFORE SERVICING THE TAPE PLAYER, CHECK THE CARTRIDGE BY SUBSTITUTION.

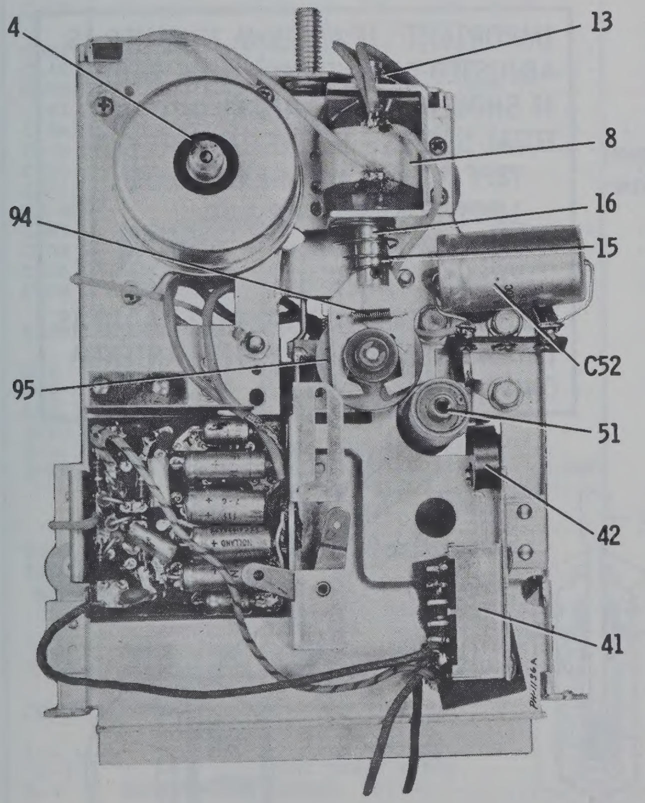
SYMPTOM	CAUSE	REMEDY
Tape breaks or winds up around capstan shaft.	1. Defective tape cartridge.	Check tape cartridge by inserting a known good tape cartridge. Before inserting new cartridge, examine actuating arm (see Cause #2).
	2. Bent or burred edge on end of micro-switch actuating arm (58).	Replace arm.
	3. Defective capstan housing (53).	Replace.
Cross-talk.	1. Defective tape cartridge.	Check tape cartridge by inserting a known good tape cartridge.
	2. Tape head (73) out of adjustment.	Check head height and azimuth adjustments with a test tape (Motorola Part No. 99P43309A01) as outlined in "Adjustments" section.
	3. Radius arms (68, 70, 77 and 78) binding.	Apply a small amount of a lightweight low temperature grease (Motorola Part Number 11P40059A55) to the ends of the radius arms. If arms are bent, replace.
	4. Head cable (76) binding.	Make certain head cable does not restrict up-and-down motion of head; dress head cable if necessary.
	5. Defective head positioning cam (95).	Replace; apply grease (Part No. 11P40059A55) to step surface on cam.
Motor runs fast.	1. Defect in regulator circuitry.	Regulator circuitry can be checked by shorting base to emitter of regulator transistor (to remove forward bias); motor should stop; if it doesn't, regulator transistor or filter capacitor is shorted.
	2. Defective motor (4).	Replace.
Slow speed (also see "Poor Tape Drive").	1. Defective tape cartridge.	Check tape cartridge by inserting a known good tape cartridge.
	2. Mechanical binding.	Check for binding by first removing tape cartridge, turn on motor with actuating arm (58) and check flywheel speed with a strobe disc (Part No. 68P40059A33 or equivalent). If speed is excessively slow, shut off unit and remove drive belt (103); flywheel should move freely when turned by hand. If it does not, check for broken or missing nylon capstan bearing (52), scored capstan shaft (51 - if severely scored, replace capstan housing - 53 also). If flywheel moves freely when turned by hand, check for defective drive belt (103), flywheel (100) or electrical problem (see Cause #3).
	3. Electrical defects:	
	A. Open regulator filter capacitor, C-52.	Replace C-52.
	B. Defective motor (4).	Check motor by grounding motor governor for an instant (junction of yellow motor wire and R-18), motor should speed up; if motor does not speed up, motor is defective. If motor does speed up, defect may be in regulator circuitry.
Poor tape drive.	1. Defective tape cartridge.	Check tape cartridge by inserting a known good tape cartridge.
	2. Grease on drive surfaces.	Use isopropyl (rubbing) alcohol sparingly and wipe dry the following: outer edge of flywheel (100), motor drive shaft (4), capstan shaft (51) and tape head (73).

TAPE PLAYER TROUBLESHOOTING CHART (CON'T)

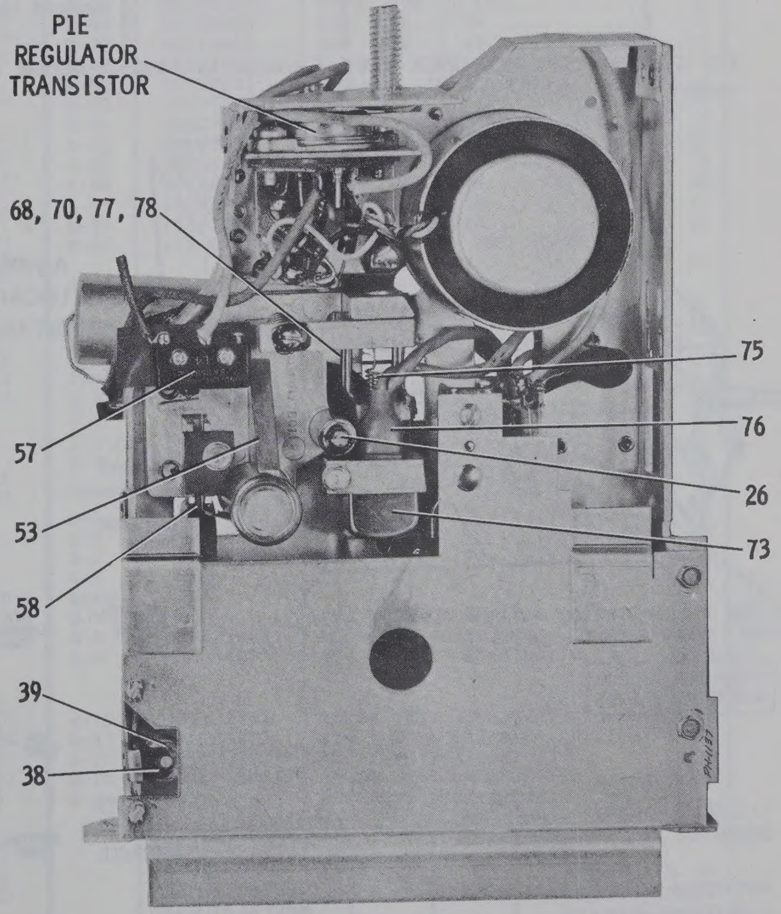
SYMPTOM	CAUSE	REMEDY
Poor tape drive (Cont'd)	3. Defective or incorrectly installed drive belt (103).	Drive belt should be replaced if stretched or banana shaped; belt should have 5 stripes and should be installed with the stripes on the outside.
	4. Cartridge retaining roller (39) not seated properly or missing.	Make certain roller is seated in spring (38); replace if missing.
	5. Flywheel (100) not seated.	Make certain flywheel is not loose and that mounting screw (101) is tight; if flywheel cannot be firmly seated, it may be necessary to replace either flywheel (100) or capstan shaft (51).
	6. Scraping cartridge.	Examine left side of tape cartridge; if severely scored, file off left front edge of tape slot or escutcheon.
	7. Scored capstan shaft (51).	Replace; if severely scored, replace capstan housing (53) also.
	8. Bent motor housing (2).	With cartridge inserted and operating, make certain drive belt (103) does not ride too high or low on brass motor pulley; bend the motor housing using wide jawed pliers if necessary. Bend the housing away from the capstan shaft if belt rides too high; bend the housing toward the shaft if belt rubs against motor housing. CAUTION: Do not apply any pressure to the brass motor pulley.
Improper or erratic head indexing.	1. Indexing solenoid screw (13) out of adjustment.	Adjust per "Adjustments" section.
	2. Defective solenoid (8), plunger (16) or return spring (15).	Repair or replace.
	3. Head tension spring (75) stretched or missing.	Repair or replace.
	4. Head cable (76) binding.	Make certain head cable does not restrict up-and-down motion of head; dress head cable to minimize binding.
	5. Cam shaft (head height - 26) screw badly out of adjustment.	Adjust per "Adjustments" section.
	6. Pawl tension spring (94) stretched or missing.	Repair or replace.
	7. Radius arms (68, 70, 77 and 78) binding.	Apply a small amount of lightweight low temperature grease (Motorola Part No. 11P40059A55) to the ends of the radius arms. If arms are bent, replace.
Motor noise from tape motor.	1. Open motor filter capacitor, C-52.	Replace capacitor.
	2. Motor case grounded to cover.	Check to see that bottom cover has an armite disc attached to it to insulate the motor case from the cover. If the disc is missing, electrical tape can be used to insulate the motor.
Squeaking or excessive wow.	1. Defective tape cartridge.	Check tape cartridge by inserting a known good tape cartridge.
	2. Broken or missing nylon capstan bearing (52).	Replace; lubricate bearing with silicon grease (Part Number 11M490487).
	3. Scored capstan shaft (51).	Replace; if severely scored, replace capstan housing (53) also.

TAPE PLAYER TROUBLESHOOTING CHART (CON'T)

SYMPTOM	CAUSE	REMEDY
Drive belt slips off flywheel (also slow tape start up).	1. Defective or incorrectly installed drive belt (103).	Drive belt should be replaced if stretched or banana shaped; belt should have 5 stripes on it and should be installed with the stripes on the outside.
	2. Motor drive shaft not vertical.	Bend the motor housing slightly away from the capstan shaft using wide jawed pliers. CAUTION: Do not apply any pressure to the brass motor pulley.
Tape motor does not run when tape cartridge is inserted.	1. Micro-switch (57) not actuated.	Bend actuating arm (58) far enough to actuate micro-switch when cartridge is inserted.
	2. Defective micro-switch (57) or defect in motor or regulator circuitry.	Check micro-switch by applying voltage directly to emitter of regulator transistor. Compare voltages in regulator circuit to those on schematic.
Intermittent audio during tape operation.	1. Loose or intermittent head cable (76).	Make certain head cable is firmly plugged into head. Cable can be checked for intermittent by wiggling; replace if necessary.
	2. Defective tape-radio switch and/or associated circuitry.	Check switch action both electrically and mechanically; replace switch if necessary.
Unit will not switch from radio to tape and/or vice versa when cartridge is inserted or removed.	1. Radio-tape changeover (41) or actuating arm (part of 41) bent or defective.	Check switch action both electrically and mechanically; replace switch if necessary.
	2. Switch cam (42) missing.	Replace cam.



TAPE DECK PARTS - TOP VIEW



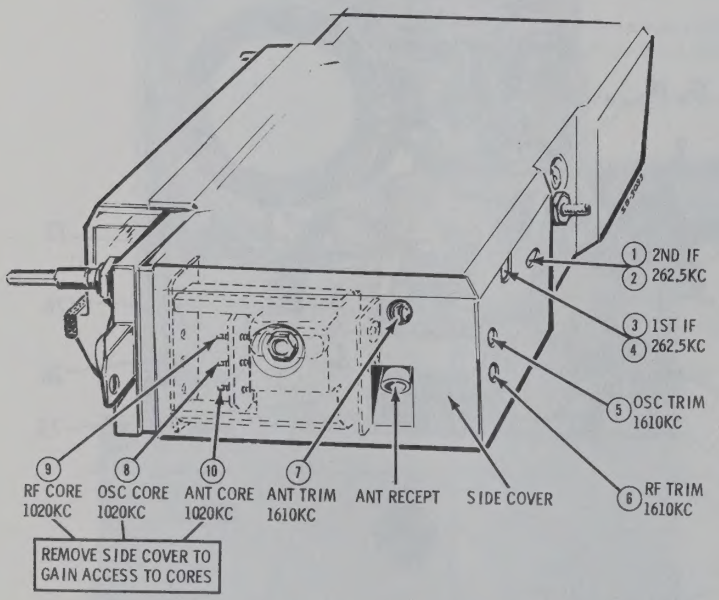
TAPE DECK PARTS - BOTTOM VIEW

RADIO ALIGNMENT

Connect an output meter across the speaker voice coil. Set volume to maximum and tone to treble. Attenuate signal generator output to maintain 2.83 volts (1 watt across 8 ohm load on either channel) on output meter at all times to prevent receiver overloading.

STEP	GENERATOR CONNECTION	GENERATOR FREQUENCY (400 cycle mod)	TUNER SET TO	ADJUST	REMARKS
IF ALIGNMENT					
1.	Antenna receptacle thru .1mf and chassis	262.5Kc	High end stop	1, 2, 3 & 4	Adjust for maximum.
RF ALIGNMENT					
2.	Antenna receptacle thru dummy (see Figure)	1610Kc	High end stop	5, 6 & 7	Adjust for maximum.
NOTE:	Do not perform Steps #3, #4, #5 and #6 unless tuner has been tampered with or components have been replaced. Before proceeding with Step #3, back tuning cores as far as possible out of coil form to eliminate their effect on trimmer adjustment. Remove crystal and dial scale to expose core screws. It will also be necessary to remove the side cover to gain access to the tuner cores (see "Service Notes" - #6).				
3.	Antenna receptacle thru dummy (see Figure)	1610Kc	High end stop	5, 6 & 7	Adjust for maximum.
4.	"	1020Kc	Tuner carriage 9/16" from high end stop	8, 9 & 10	Adjust for maximum.
5.	"	1610Kc	High end stop	5, 6 & 7	Adjust for maximum.
6.	Repeat Steps #4 and #5 until no further increase; Step #5 should be last step. Then, cement core in place.				
ANTENNA TRIMMER					
7.	---	---	Weak station around 1600Kc	7	Adjust for maximum with radio installed in car and antenna fully extended.

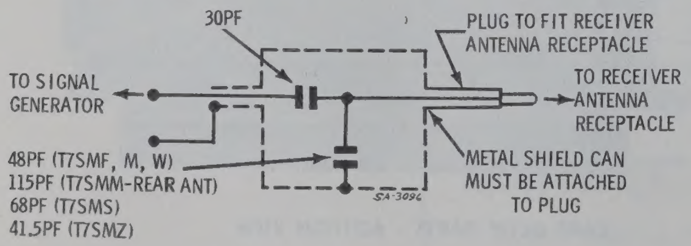
TO CALIBRATE POINTER - Tune radio to 1000Kc signal and reposition pointer on dial scale with the center of the 1000Kc mark on dial scale.


① 2ND IF
② 262.5KC
③ 1ST IF
④ 262.5KC
⑤ OSC TRIM 1610KC
⑥ RF TRIM 1610KC
⑨ RF CORE 1020KC
⑧ OSC CORE 1020KC
⑩ ANT CORE 1020KC
⑦ ANT TRIM 1610KC
ANT RECEPT
SIDE COVER
REMOVE SIDE COVER TO GAIN ACCESS TO CORES

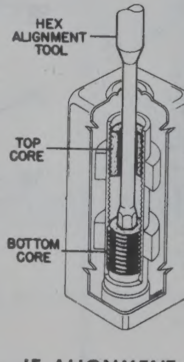
ALIGNMENT LOCATION DETAIL

IMPORTANT: IF ANTENNA TRIMMER IS ADJUSTED DURING REPAIR OF RADIO, IT SHOULD BE READJUSTED WITH A TOTAL SERIES - SHUNT CAPACITY OF:
- 78PF (T7SMF, W, M-FRONT ANT)
- 145PF (T7SMM-REAR ANT)
- 98PF (T7SMS)
- 71.5PF (T7SMZ)

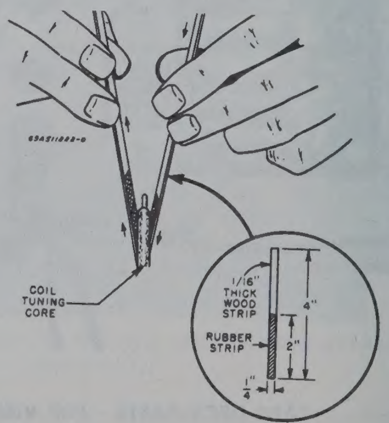
THIS IS NECESSARY SO THAT RADIO IS TRIMMED ESSENTIALLY WITH ANTENNA ON VEHICLE.


30PF
PLUG TO FIT RECEIVER ANTENNA RECEPTACLE
TO SIGNAL GENERATOR
TO RECEIVER ANTENNA RECEPTACLE
48PF (T7SMF, M, W)
115PF (T7SMM-REAR ANT)
68PF (T7SMS)
41.5PF (T7SMZ)
METAL SHIELD CAN MUST BE ATTACHED TO PLUG
SA-3096

DUMMY ANTENNA


HEX ALIGNMENT TOOL
TOP CORE
BOTTOM CORE

IF ALIGNMENT DETAIL


COIL TUNING CORE
1/16" THICK WOOD STRIP
RUBBER STRIP
4"
2"
1/4"

CORE ALIGNMENT TOOL DETAIL

REPLACEMENT PARTS LIST

Ref. No.	Part Number	Description	List Price
		ELECTRICAL PARTS	
CAPACITORS - NOTE:		The capacitors in this list are recommended replacement types for the original equipment; all are ceramic disc type unless otherwise specified.	
C-1	20C40746A06	ANTENNA TRIMMER...........	.85
C-2	21D40339A83	330 pf 20% 100V (USE 21K752589)...............	.25
C-3	20C40254A14	DUAL TRIMMER: C3A 25 to 150 pf C3B 25 to 150 pf...	1.15
C-4	21D40536A30	180 pf 10% 100V N750....	.20
C-5	8C42750A06	.01 mf 20% 100V mylar...	.25
C-6	23C43280A02	2 mf +40-20% 10V lytic..	.45
C-7	21C40367A19	250 pf 5% 100V..........	.40
C-8	8C42750A06	.01 mf 20% 100V mylar...	.25
C-9	8C42750A06	.01 mf 20% 100V mylar...	.25
C-10	21D40536A49	180 pf 5% 100V N750.....	.25
C-11	8C42750A20	.0047 mf 10% 100V mylar (USE 8C40906A27)..........	.30
C-12	21C40367A14	160 pf 5% 100V MICA (USE 21C40367A09).........	.30
C-13	8C42750A35	.002 mf 10% 100V mylar..	.30
C-14	8C42750A13	.1 mf 20% 100V mylar (USE 8C40906A05)..........	.35
C-15	23C43280A03	10 mf +40-20% 6V lytic..	.55
C-16	21D40339A44	150 pf 10% 100V.........	.20
C-17	8C42750A06	.01 mf 20% 100V mylar...	.25
C-18	23C40302A07	500-500 mf 16V lytic (USE 23C40302A04).........	3.40
C-20 thru C-29	---	SEE TAPE DECK PARTS	
C-30	23C41928A33	32 mf 10V lytic..........	.65
C-31	23C41928A33	32 mf 10V lytic..........	.65
C-32	23C43280A21	.5 mf +40-20% 15V lytic.	.30
C-33	23C43280A21	.5 mf +40-20% 15V lytic.	.30
C-34	23C43280A14	.1 mf 15V lytic..........	.35
C-35	23C43280A14	.1 mf 15V lytic..........	.35
C-36	21C41680A15	.22 mf +80-20% 12V.......	.35
C-37	21C41680A15	.22 mf +80-20% 12V.......	.35
C-38	23C43280A02	2 mf +40-20% 10V lytic..	.45
C-39	23C43280A02	2 mf +40-20% 10V lytic..	.45
C-40	21D40339A87	.0015 mf 10% 100V........	.20
C-41	21D40339A87	.0015 mf 10% 100V........	.20
C-42	21D40536A50	22 pf 10% 100V N150 (USE 21R120539)...........	.25
C-43	21D40536A50	22 pf 10% 100V N150 (USE 21R120539)...........	.25
C-44	23C41928A23	80 mf 16V lytic..........	.65
C-45	23C41928A23	80 mf 16V lytic..........	.65
C-46	21D40339A87	.0015 mf 10% 100V........	.20
C-47	21D40339A87	.0015 mf 10% 100V........	.20
C-48	23C41928A29	1000 mf 16V lytic........	1.65
C-49	21S132103	.01 mf +80-20% 100V......	.25
C-50	23C41928A29	1000 mf 16V lytic........	1.65
C-51, C-52	---	SEE TAPE DECK PARTS	
C-53	8C40906A05	.1 mf 20% 100V mylar....	.35
C-54	21S132103	.01 mf +80-20% 100V......	.25
C-55	21S132103	.01 mf +80-20% 100V......	.25
C-56	21S132103	.01 mf +80-20% 100V......	.25
MISCELLANEOUS ELECTRICAL PARTS			
E-1	48S134816	DIODE, silicon............	.35
E-2	48S134816	DIODE, silicon............	.35
E-3 thru E-9	---	SEE TAPE DECK PARTS	
E-10	65B40304A01	BULB, dial: .33A-14V (T7SMF T7SMM, T7SMW & T7SMZ).....	.25
	65S135829	BULB, dial: 1.5CP-18V (T7SMS)..................	.25
E-12	---	SEE MECHANICAL PARTS	
E-13, E-14	---	SEE TAPE DECK PARTS	
	50B40943B01	SPEAKER, hang-on (T7SMM)...	13.00
	50B40943B01	SPEAKER, hang-on (T7SMM)...	13.00
	50B40844B01	SPEAKER, panel (T7SMW).....	13.20
	50B40844B01	SPEAKER, panel (T7SMW).....	13.20
COILS & CHOKES			
L-1, L-2, L-3	---	SEE TUNER PARTS	
L-4	25D43221A24	CHOKE, filter.............	3.95

Ref. No.	Part Number	Description	List Price
RESISTORS & CONTROLS			
R-1	6S127800	220 10% 1/4W.............	.17
R-2	6S127800	220 10% 1/4W.............	.17
R-3	6S129775	330 10% 1/4W.............	.17
R-4	6S129145	82K 10% 1/4W.............	.17
R-5	6S129144	68K 10% 1/4W.............	.17
R-6	6S127806	27K 10% 1/4W.............	.17
R-7	6S129981	3300 5% 1/4W.............	.33
R-8	6S128689	2200 10% 1/4W............	.17
R-9	6S128687	6800 10% 1/4W............	.17
R-10	6S127804	4700 10% 1/4W............	.17
R-11	6S127807	33K 10% 1/4W.............	.17
R-12	6S129226	100K 10% 1/4W............	.17
R-13	6S127800	220 10% 1/4W.............	.17
R-14	6S128687	6800 10% 1/4W............	.17
R-15	6S129146	150K 10% 1/4W............	.17
R-16	6S127803	1500 10% 1/4W............	.17
R-17	6S127633	470 10% 1/2W.............	.17
R-18, R-19	---	SEE TAPE DECK PARTS	
R-20	6S129148	470K 10% 1/4W	
R-21 thru R-36	---	SEE TAPE DECK PARTS	
R-41	18B40258B01	CONTROL, balance (T7SMF)...	1.95
	18B40259B01	CONTROL, balance (T7SMM, T7SMS, T7SMW & T7SMZ).....	2.00
R-42	---	SEE TAPE DECK PARTS	
R-43	---	SEE TAPE DECK PARTS	
R-44	6S127803	1500 10% 1/4W............	.17
R-45	6S127803	1500 10% 1/4W............	.17
R-46	18C40257B01	CONTROL, multiple (T7SMF)..	10.15
	18C40171B01	CONTROL, multiple (T7SMM, T7SMS, T7SMW & T7SMZ).....	10.10
R-48	6S121301	1000 10% 1/2W............	.17
R-49	6S121301	1000 10% 1/2W............	.17
R-50	6S129147	220K 10% 1/4W............	.17
R-51	6S131377	15 10% 1/4W..............	.17
R-52	6S129147	220K 10% 1/4W............	.17
R-53	6S131377	15 10% 1/4W..............	.17
R-54	6S129433	5600 10% 1/4W............	.17
R-55	6S129433	5600 10% 1/4W............	.17
R-56	6S128903	39K 10% 1/4W.............	.17
R-57	6S128903	39K 10% 1/4W.............	.17
R-58	6S127001	2.2 meg 10% 1/2W.........	.17
R-59	6S127001	2.2 meg 10% 1/2W.........	.17
R-60	6S127802	1000 10% 1/4W............	.17
R-61	6S127802	1000 10% 1/4W............	.17
R-62	6S127099	220 10% 1/2W.............	.17
R-63	6S127099	220 10% 1/2W.............	.17
R-64	6S129753	100 10% 1/4W.............	.17
R-65	6S129753	100 10% 1/4W.............	.17
R-66	6S127800	220 10% 1/4W.............	.17
R-67	17B40756A04	.20 5% WW PTC (USE 17B40756A06)..............	.25
R-68	17B40756A04	.20 5% WW PTC (USE 17B40756A06)..............	.25
R-69	6S129101	680 10% 1/2W.............	.17
R-72	---	SEE TAPE DECK PARTS	
TRANSFORMERS			
T-1	24D42517A27	IF........................	1.60
T-2	24D42517A28	DIODE.....................	1.75
T-3	25D41307B05	OUTPUT....................	1.55
T-4	25D41307B07	OUTPUT....................	1.55
TRANSISTORS			
Q-1	48S134805	M25.......................	1.45
Q-2	48S134804	25A.......................	1.45
Q-3	48S134807	M24.......................	1.45
Q-4 thru Q-7	---	SEE TAPE DECK PARTS	
Q-8	48S134673	M54 (USE 48B134810)........	1.60
Q-9	48S134673	M54 (USE 48B134810)........	1.60
Q-10	48S134751	2N176 (USE 48S134747)......	3.25
Q-11	48S134673	M54 (USE 48B134810)........	1.60
Q-12	48S134673	M54 (USE 48B134810)........	1.60
Q-13	48S134751	2N176 (USE 48S134747)......	3.25
Q-14	---	SEE TAPE DECK PARTS	
		MECHANICAL PARTS - MODEL T7SMF	
	84D43708A05	BOARD, plated chassis: audio.....................	2.10
	84D43707A01	BOARD, plated chassis: RF..	1.10

Ref. No.	Part Number	Description	List Price
	30C43056A05	CABLE & PLUG ASSEM: 2-conn (pwr & dial lite - USE 30C43056A08)	.40
E-12	30C42940A07	CABLE & PLUG ASSEM: 3-conn (spkr)	.70
	59D43662A02	CARTRIDGE, tape	29.75
	15D40224B01	COVER, bottom	.65
	15C41342B01	COVER, instr cluster	14.65
	15D40279B01	COVER, top	.70
	61C40240B01	CRYSTAL, dial	1.25
	61A40745B01	DIFFUSER, lite	.25
	15C40278B02	DOOR, cartridge	3.45
	14A543810	INSULATOR, transistor	.10
	36D40840B02	KNOB, on-off, vol, tuning & indexing	.55
	49B40863B01	KNOB, tone & bal	.45
	2S121771	NUT, hex: 3/8-32 (cont mtg)	.03
	2K565333	NUT, hex: 1/4-20 (radio mtg)	.05
	52C40244B03	POINTER, dial	.35
	9A531066	RECEPTACLE, antenna	.15
	47A43513A04	ROD, cartridge door	.10
	34C40239B01	SCALE, dial	.80
	3K560695	SCREW, special: trans mtg	.03
	47B40326B01	SHAFT, tuning: incl disc	.60
	9D41648A16	SOCKET, dial lite	.30
	9C43089A01	SOCKET, transistor	.25
	41A41233B01	SPRING, anti-backlash: pointer	.30
	41A40475B02	SPRING, cartridge door	.10
	41B41805A01	SPRING, pointer tension	.10
	4C40246A06	WASHER, "C": pointer	.03

MECHANICAL PARTS - MODEL T7SMM

Ref. No.	Part Number	Description	List Price
	13B43812A02	BEZEL, fader control	1.20
	13C40185B03	BEZEL, tape cartridge	3.90
	84D43708A05	BOARD, plated chassis: audio	2.10
	84D43707A01	BOARD, plated chassis: RF	1.10
	7B43780A01	BRACKET, mtg: fader control	1.10
	7B40122B01	BRACKET, mtg: fader control	.70
	30C43056A08	CABLE & PLUG ASSEM: 2-conn (pwr & dial lite)	.40
E-12	30C42940A11	CABLE & PLUG ASSEM: 3-conn (spkr leads - USE 30C42940A08)	.55
	30B41260B01	CABLE & PLUG ASSEM: front to rear spkrs; 165"	14.70
	30C40939B01	CABLE & PLUG ASSEM: incl fader control	5.25
	30B41262B01	CABLE & PLUG ASSEM: LH spkr adaptor; front to rear	3.10
	30B41261B01	CABLE & PLUG ASSEM: RH spkr adaptor; front to rear	2.10
	59D43662A02	CARTRIDGE, tape	29.75
	15D40224B01	COVER, bottom	.65
	15D40279B01	COVER, top	.70
	61C40929B01	CRYSTAL, dial	1.55
	61B40812B01	DIFFUSER, lite	.60
	15C40278B02	DOOR, cartridge	3.45
	15T40941B01	HOUSING, instr cluster	13.60
	14A543810	INSULATOR, transistor	.10
	49B40863B01	KNOB, disc: tone & bal	.45
	36C40123B01	KNOB, fader	.80
	36B40840B02	KNOB, on-off, vol, tuning & indexing	.55
	2S121771	NUT, hex: 3/8-32(control mtg)	.03
	2K565333	NUT, hex: 1/4-20 (radio mtg)	.05
	2B43813A01	NUT, spcl: 3/8-32 (fader cont mtg)	.75
	64C40944B01	PLATE, radio mtg	.75
	52C40244B02	POINTER, dial	.35
	9A531066	RECEPTACLE, antenna	.15
	47A43513A04	ROD, cartridge door	.10
	34C40319B02	SCALE, dial	.65
	3K560695	SCREW, spcl: trans mtg	.03
	9D41648A16	SOCKET, dial lite	.30
	9C43089A01	SOCKET, transistor	.25
	41A41233B01	SPRING, anti-backlash; pointer	.30
	41A40475B01	SPRING, cartridge door	.15
	41B41247B01	SPRING, pointer tension	.30
	4K721821	WASHER, "C": pointer	.03

MECHANICAL PARTS - MODEL T7SMS

Ref. No.	Part Number	Description	List Price
	34C40319B01	BACKGROUND, dial	.65
	13C40185B03	BEZEL, dial	3.90
	84D43708A05	BOARD, plated chassis: audio	2.10
	84D43707A01	BOARD, plated chassis: RF	1.10
E-12	30C42940A09	CABLE & PLUG ASSEM: 3-conn (spkr)	.45
	30C43056A07	CABLE & PLUG ASSEM: pwr & dial lite - USE 30C43056A08)	.40
	15D40224B01	COVER, bottom	.65
	15D40270B01	COVER, top	.70
	15C40278B01	DOOR, cartridge tape	2.85
	14A543810	INSULATOR, transistor	.10
	2S121771	NUT, hex: 3/8-32 (cont mtg)	.03
	2K565333	NUT, hex: 1/4-20 (rear radio mtg)	.05
	52C40244B02	POINTER, dial	.35
	9A531066	RECEPTACLE, antenna	.15
	47A43513A04	ROD, cartridge door	.10
	61C40184B01	SCALE, dial	2.40
	3K560695	SCREW, special: trans mtg	.03
	9D41648A16	SOCKET, dial lite	.30
	9C43089A01	SOCKET, transistor	.25
	41A41233B01	SPRING, anti-backlash; pointer	.30
	41A40475B01	SPRING, cartridge door	.15
	41B41247B01	SPRING, pointer tension	.30
	4K721821	WASHER, "C": pointer	.03

MECHANICAL PARTS - MODEL T7SMW

Ref. No.	Part Number	Description	List Price
	13D40838B01	BEZEL, radio	.60
	13C40185B03	BEZEL, tape cartridge	3.90
	84D43708A05	BOARD, plated chassis: audio	2.10
	84D43707A01	BOARD, plated chassis: RF	1.10
	30C43056A05	CABLE & PLUG ASSEM: 2-conn (pwr & dial lite - USE 30C43056A08)	.40
E-12	30C42940A08	CABLE & PLUG ASSEM: 3-conn (spkr)	.70
	30B43928A01	CABLE & PLUG ASSEM: panel spkrs	10.90
	59D43662A02	CARTRIDGE, tape	29.75
	15D40224B01	COVER, bottom	.65
	15D40279B01	COVER, top	.70
	61C41235B01	CRYSTAL, dial	1.55
	61B40812B01	DIFFUSER, lite	.60
	15C40278B02	DOOR, cartridge	3.45
	14A543810	INSULATOR, transistor	.10
	49B40863B02	KNOB, disc: tone & bal	.45
	36B40840B01	KNOB, on-off, vol, tuning & indexing	.55
	2S121771	NUT, hex: 3/8-32 (cont mtg)	.03
	2K565333	NUT, hex: 1/4-20 (radio mtg)	.05
	52C40244B02	POINTER, dial	.35
	9A531066	RECEPTACLE, antenna	.15
	47A43513A04	ROD, cartridge door	.10
	34C40319B02	SCALE, dial	.65
	3K560695	SCREW, spcl: trans mtg	.03
	9D41648A16	SOCKET, dial lite	.30
	9C43089A01	SOCKET, transistor	.25
	41A41233B01	SPRING, anti-backlash; pointer	.30
	41A40475B01	SPRING, cartridge door	.15
	41B41247B01	SPRING, pointer tension	.30
	4K721821	WASHER, "C": pointer	.03

MECHANICAL PARTS - MODEL T7SMZ

Ref. No.	Part Number	Description	List Price
	34C40319B01	BACKGROUND, dial	.65
	13D40838B01	BEZEL, radio	.60
	13C40185B03	BEZEL, tape cartridge	3.90
	84D43708A05	BOARD, plated chassis: audio	2.10
	84D43707A01	BOARD, plated chassis: RF	1.10
	30C43056A05	CABLE & PLUG ASSEM: 2-conn (pwr & dial lite - USE 30C43056A08)	.40
E-12	30C42940A08	CABLE & PLUG ASSEM: 3-conn (spkr)	.55
	30B43928A01	CABLE, spkr hang-on	10.90
	59D43662A02	CARTRIDGE, tape	29.75

Ref. No.	Part Number	Description	List Price
	15D40224B01	COVER, bottom	.65
	15D40279B01	COVER, top	.70
	61A40745B02	DIFFUSER, dial lite	.35
	15C40278B01	DOOR, cartridge	2.85
	14A543810	INSULATOR, transistor	.10
	36B40840B01	KNOB, on-off, vol & indexing	.55
	49B40863B02	KNOB, tone & bal	.45
	2S121771	NUT, hex: 3/8-32 (cont & tuning shaft)	.03
	2K565333	NUT, hex: 1/4-20 (rear radio mtg)	.05
	52C40244B02	POINTER, dial	.35
	9A531066	RECEPTACLE, ant	.15
	47A43513A04	ROD, cartridge door	.10
	61C40931B01	SCALE, dial	2.10
	3K560695	SCREW, spcl: trans mtg	.03
	9D41648A16	SOCKET, dial lite	.30
	9C43089A01	SOCKET, transistor	.25
	41A41233B01	SPRING, anti-backlash; pointer	.30
	41A40475B01	SPRING, cartridge door	.15
	41B41247B01	SPRING, tension: pointer	.30
	4K721821	WASHER, "C": pointer	.03

INSTALLATION PARTS - MODEL T7SMF

Ref. No.	Part Number	Description	List Price
	1V41300B04	RADIO INSTALLATION KIT	3.35
	7T41359B01	BRACKET, rear	.40
	8B43668A01	CAPACITOR, volt reg	1.10
	24B41263B01	CHOKE	.85
	2A563491	NUT, stamped: 1/4-20 (radio mtg)	.03
	3B40245A05	SCREW, mach: 1/4-20 x 3/8	.10
	3B41042A14	SCREW, tpg: #8-18 x 3/8	.03
	3B40377A01	SCREW & WASHER: 1/4-20 x 3/8	.10
	3B40377A02	SCREW & WASHER: 1/4-20 x 1/2	.05
	42B43682A01	STRAP, hood grnd	.20
	1K534254	WHEEL STATIC COLLECTOR	.25

INSTALLATION PARTS - MODEL T7SMM

Ref. No.	Part Number	Description	List Price
	1V40800B91	RADIO INSTALLATION KIT	6.00
	7B40945B01	BRACKET, radio mtg	.25
	8B43668A01	CAPACITOR, volt reg	1.10
	24B41263B01	CHOKE, CV	.85
	2S121771	NUT, hex: 3/8-32 (front radio mtg)	.03
	2K565370	NUT, hex: 1/4-20 (rear radio mtg)	.05
	3B41448A05	SCREW, tpg: 8-32 x .375 (to secure mtg plate)	.03
	3B41042A13	SCREW, tpg: 10-12 x 1/2 (spkr mtg)	.03
	3B40377A01	SCREW & WASHER: 1/4-20 (radio mtg)	.10
	41B40942B01	SPRING, static collector: wheel	.50
	42B41344B01	STRAP, grnd	.15
	42B42475A01	STRAP, hood grnd	.15
	1K534254	WHEEL STATIC COLLECTOR	.25
	1V40800B83	RADIO INSTALLATION KIT	3.35
	7B40837B01	BRACKET, rear supp	.20
	8B43668A01	CAPACITOR, volt reg	1.10
	2S121771	NUT, hex: 3/8-32 (front radio mtg)	.03
	2A563491	NUT, hex: 1/4-20 (radio mtg)	.03
	3B41042A11	SCREW, tpg: 8-15 x 1/2	.03
	3K565347	SCREW & WASHER: 1/4-20 (radio mtg)	.05
	42B43682A01	STRAP, hood grnd	.20
	1K534254	WHEEL STATIC COLLECTOR	.25

INSTALLATION PARTS - MODEL T7SMZ

Ref. No.	Part Number	Description	List Price
	1V41001B86	RADIO INSTALLATION KIT	3.50
	7B40837B01	BRACKET, radio supp: rear	.20
	8B43668A01	CAPACITOR, volt reg	1.10
	2S121771	NUT, hex: 3/8-32 (front radio mtg)	.03
	2A563491	NUT, stamped: 1/4-20 (radio mtg)	.03
	3K565347	SCREW & WASHER: 1/4-20 (radio mtg)	.05
	3A41442B01	SCREW & WASHER: 8-15 x .62 (hood strap mtg)	.05
	42B43682A01	STRAP, hood grnd	.20
	1K534254	WHEEL STATIC COLLECTOR	.25

TUNER PARTS - ALL MODELS

Ref. No.	Part Number	Description	List Price
	1U43500A13	TUNER, MFT598: compl (T7SMF)	12.10
	1U43500A12	TUNER, MFT585: compl (T7SMM, T7SMS, T7SMW & T7SMZ)	12.05
	1V40400B33	COILS & MTG PLATE ASSEM: incl L-1, 2 & 3	3.35
	76C40706A10	CORE, tuning: ant & RF	.40
	76C40647A10	CORE, tuning: osc	.40
	47B43570A03	SHAFT, tuning: incl pinch washers (MFT598)	.45
	47B40293B01	TUNING SHAFT ASSEM: (MFT585)	.65
	4K692188	WASHER, "C": front shaft mtg	.03
	4C40246A06	WASHER, "C": front shaft mtg	.03
	4C40104A15	WASHER, spring: front shaft mtg (MFT585)	.10
	4A40210A02	WASHER, spring: rear shaft mtg	.05
	4C40104A08	WASHER, spring: rear shaft mtg	.10

TAPE DECK - ELECTRICAL PARTS

CAPACITORS - NOTE: The capacitors in this list are recommended replacement types for the original equipment; all are ceramic disc type unless otherwise specified.

Ref. No.	Part Number	Description	List Price
C-20	23C41928A24	20 mf 16V lytic	.65
C-21	23C41928A24	20 mf 16V lytic	.65
C-22	23C41928A20	40 mf 16V lytic	1.05
C-23	23C41928A20	40 mf 16V lytic	1.05
C-24	21D40339A86	180 pf 10% 100V	.25
C-25	21D40339A86	180 pf 10% 100V	.25
C-26	23C41928A23	80 mf 16V lytic	.65
C-27	23C41928A23	80 mf 16V lytic	.65
C-28	8C42750A20	.0047 mf 10% 100V mylar (USE 8C40906A27)	.30
C-29	8C42750A20	.0047 mf 10% 100V mylar (USE 8C40906A27)	.30
C-51	8C40906A05	.1 mf 20% 100V mylar	.35
C-52	23C41928A19	500 mf +50-10% 16V lytic	2.00

MISCELLANEOUS ELECTRICAL PARTS

Ref. No.	Part Number	Description	List Price
E-3	59C43543A02	MOTOR, regulated DC	21.95
E-5	40B40296B01	SWITCH, leaf contact	1.25
E-6	24B43679A02	SOLENOID	2.55
E-7	59C43542A01	HEAD, stereo	12.25
E-8	40B43656A01	SWITCH, slide: tape-radio	2.35
E-9	30C40643B01	CABLE, tape head	1.35
E-13	48S41508A01	RECTIFIER, silicon	1.00
E-14	40B40406B01	SWITCH, micro	2.65

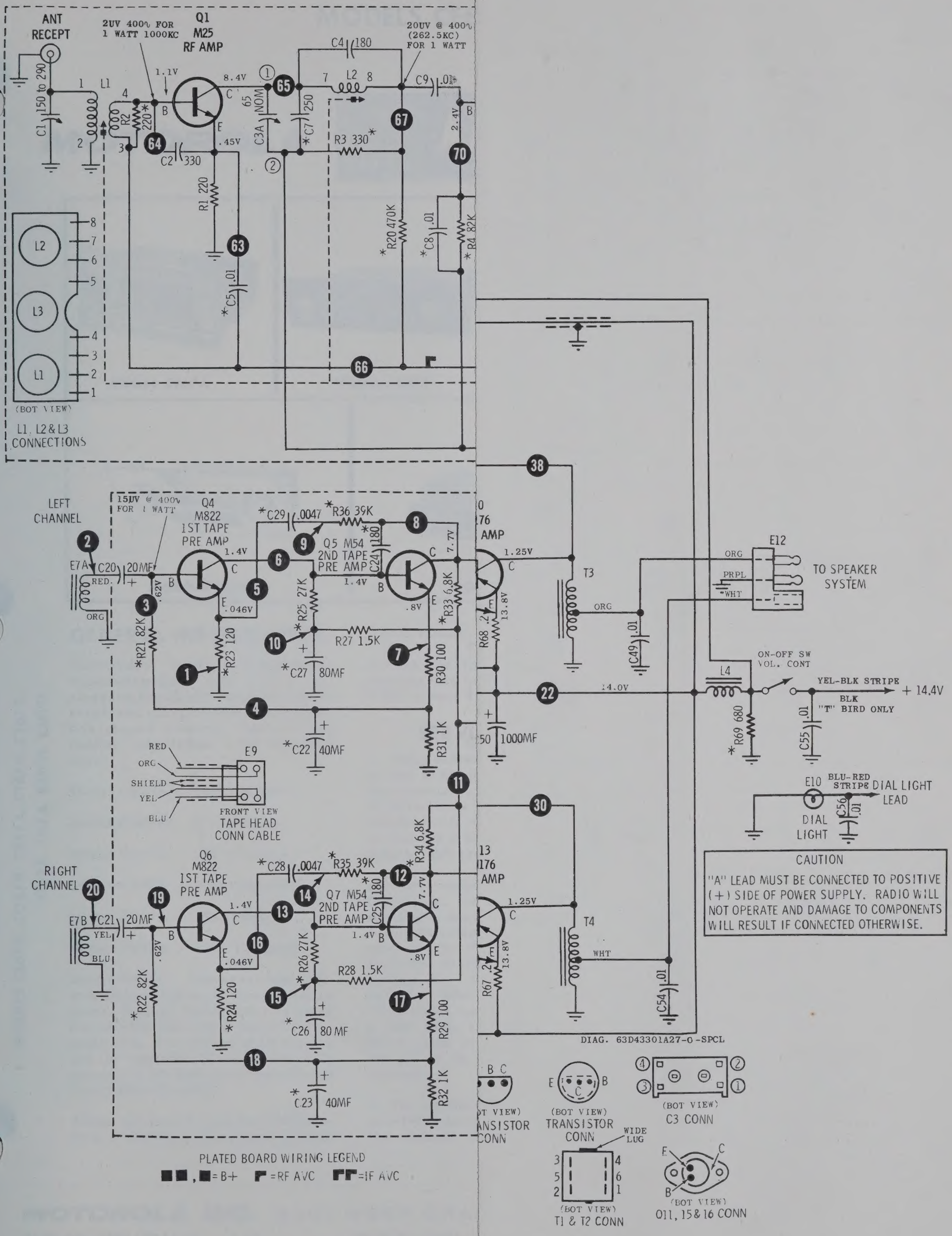
RESISTORS

Ref. No.	Part Number	Description	List Price
R-18	6S131919	33 10% 1/2W	.17
R-19	6S124797	150 10% 1/2W	.17
R-21	6S129145	82K 10% 1/4W	.17
R-22	6S129145	82K 10% 1/4W	.17
R-23	6S129617	120 10% 1/4W	.17
R-24	6S129617	120 10% 1/4W	.17
R-25	6S127806	27K 10% 1/4W	.17
R-26	6S127806	27K 10% 1/4W	.17
R-27	6S127803	1500 10% 1/4W	.17
R-28	6S127803	1500 10% 1/4W	.17
R-29	6S129753	100 10% 1/4W	.17
R-30	6S129753	100 10% 1/4W	.17
R-31	6S127802	1000 10% 1/4W	.17
R-32	6S127802	1000 10% 1/4W	.17
R-33	6S128687	6800 10% 1/4W	.17
R-34	6S128687	6800 10% 1/4W	.17
R-35	6S128903	39K 10% 1/4W	.17
R-36	6S128903	39K 10% 1/4W	.17
R-42	6S127802	1000 10% 1/4W	.17
R-43	6S127802	1000 10% 1/4W	.17
R-72	6S127534	820 10% 1/2W	.17

Ref. No.	Part Number	Description	List Price
TRANSISTORS			
Q-4	48S134823	M822	1.50
Q-5	48S134673	M54 (USE 48S134810)	1.60
Q-6	48S134823	M822	1.50
Q-7	48S134673	M54 (USE 48S134810)	1.60
Q-14	48S134930	PIE	
		MECHANICAL PARTS	
2	26B40399B01	SHIELD, motor mtg	1.45
3	7A43576A01	SUPPORT, motor: rubber	.15
4	---	SEE E-3 IN ELECTRICAL PARTS	
5	7A43576A01	SUPPORT, motor: rubber	.15
6	55B40606B01	PAWL, pull ratchet: "B"	.10
7	22B43667A04	PIN, spiral: solenoid plunger	.05
8	---	SEE E-6 IN ELECTRICAL PARTS	
11	4C40104A14	WASHER, spring: solenoid stop	.10
12	2S8357	NUT, hex: 5/16-32 (to secure solenoid stop)	.10
13	46A40299B01	STOP, solenoid	1.20
15	*41B41716B02	SPRING, plunger return	
16	47A40298B01	PLUNGER, solenoid	1.20
17	55B40605B01	PAWL, push ratchet: "A"	.10
18	3K564805	SCREW, spcl: transistor mtg	.03
19	3K564805	SCREW, spcl: transistor mtg	.03
20	---	SEE Q-14 IN ELECTRICAL PARTS	
21	14A543810	INSULATOR, transistor	.10
23	9C43089A02	SOCKET, transistor (USE 9C43089A01)	.25
25	41B41251B01	SPRING, cam tension	.03
26	47B40414B01	SHAFT, cam	1.15
38	1V41001B18	SPRING & ROLLER ASSEM: cartridge: incl items 36-40	.60
39	49A43658A03	ROLLER, cartridge ret: solid metal (cartridge spring-in some sets)	.25
	49A41281B01	ROLLER, cartridge ret: drilled (cartridge spring-in some sets)	.20
40	22C42038A05	PIN, drive: cartridge tension spring	.05
41	---	SEE E-8 IN ELECTRICAL PARTS	
42	45B40495B01	CAM, switch: tape-radio	.30
43	4C40246A08	WASHER, "C"	.03
45	2S7007	NUT, hex: 8-32 x 1/4 (to secure cam shaft)	.03
46	4C40539B01	WASHER, "C": ext (flywheel shaft-to retain thrust washers & bearings)	.03
47	4A40409B01	WASHER, thrust: flywheel shaft	.10
48	43B40411B02	BEARING, thrust: capstan shaft	.25
49	4A40409B01	WASHER, thrust: flywheel shaft	.10
50	4C40538B01	WASHER, "C": int (to secure flywheel shaft)	.03
51	47P40059A45	SHAFT, capstan: incl item 52	2.10
52	43A43867A01	BEARING, nylon: capstan shaft	.05
53	15P40059A44	CAPSTAN HSG ASSEM	4.90
54	41A40444B01	SPRING, azimuth tension	.05
55	3S129610	SCREW, mach: 4-40 x 1; sl rnd hd (azimuth adjust)	.03
56	14A40452B01	INSULATOR, micro sw	.05
57	---	SEE E-14 IN ELECTRICAL PARTS	
58	45B40480B01	ARM, micro-sw act	.25
59	3S135649	SCREW, tpg: 2-56 x 1/2; phl rnd hd (micro sw mtg).	.05
60	3S135649	SCREW, tpg: 2-56 x 1/2; phl rnd hd (micro sw mtg).	.05
61	64P40059A47	TAPE GUIDE BRACKET: incl items 62 & 64	1.10
61A	46B41160B01	STOP, tape	
63	3S132752	SCREW, mach: 4-40 x 1-7/16; pln hex (tape guide brkt).	.05
65	3S132645	SCREW, mach: 4-40 x 7/32 (act arm ret)	.03
66	26A40607B01	RETAINER, actuating arm	.05
67	43A41239B01	SPACER, tape guide bracket.	.40
68	45A41230B01	ARM, radius: right	.15
69	42A41229B01	CLIP, spring: radius arms retaining	.15
70	45A41231B01	ARM, radius: left	.15
71	3S135915	SCREW, mach: 4-40 x 3/8; phl rnd hd (head mtg-in some sets)	.05
72	3S9718	SCREW, set: 4-40 x 1/8 (head mtg-in some sets)...	.10
73	---	SEE E-7 IN ELECTRICAL PARTS	
74	46P40059A46	RETAINER, stereo hd: incl pin	1.50
75	41A40540B01	SPRING, head tension	.20
76	---	SEE E-9 IN ELECTRICAL PARTS	
77	45A41231B01	ARM, radius: left	.15
78	45A41230B01	ARM, radius: right	.15
79	42A41229B01	CLIP, spring: radius arms retaining	.15
80	---	SEE E-5 IN ELECTRICAL PARTS	
82	49A43659A02	ROLLER, deck slide: plastic	.40
83	22B43667A03	PIN, spiral: deck slide roller	.05
84	84D43709A03	BOARD, plated chassis: pre-amp; less all components	1.75
93	2S131435	NUT, hex: 4-40 x 1/4 (to secure tape guide bracket.	.10
94	41A40681B01	SPRING, pawl tension	.25
95	45C40428B01	CAM, head positioning	1.75
96	4A40409B03	WASHER, thrust: .126 x .50 (cam shaft)	.10
97	43B40411B01	BEARING, thrust: cam shaft.	.25
98	4A40409B02	WASHER, thrust: .126 x .312 (cam shaft)	.10
99	4C40246A08	WASHER, "C"	.03
100	49C40416B02	FLYWHEEL	3.95
101	3S124763	SCREW, mach: 6-32 x 1/4; phl trs hd (flywheel mtg)	.05
103	42B40426B01	BELT, drive	.70

Ref. No.	Part Number	Description	List Price
	ACCESSORY SERVICE AIDS & TOOLS		
	99P43309A01	CARTRIDGE, test tape	
	*68P40059A33	DISC, strobe (flywheel	
	11M490487	GREASE, silicon	
	*11P40059A55	GREASE, special, lightweight low temperature type	
	*66T40059A54	PLIERS, tru-arc (for removing item 46)	

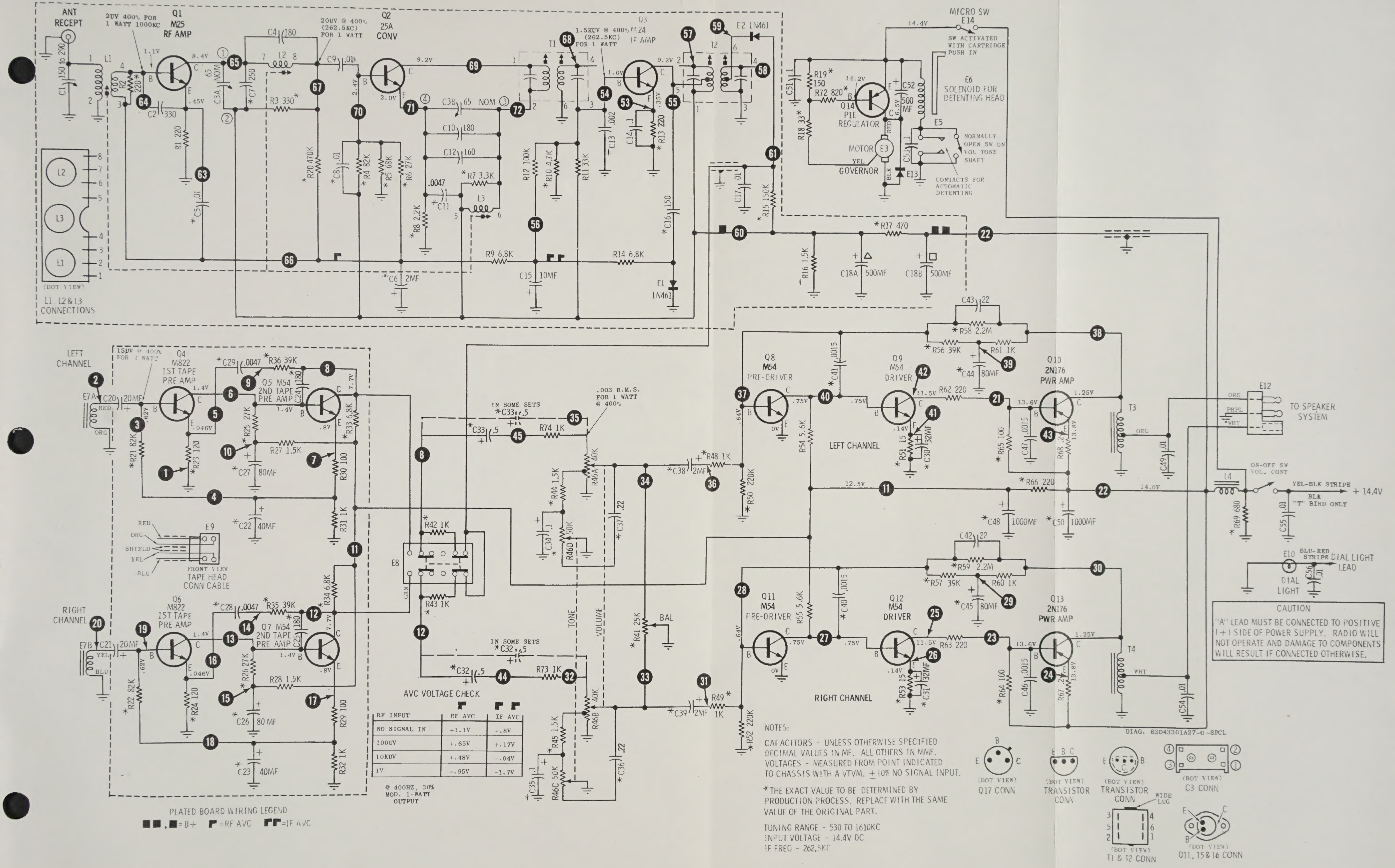
*DENOTES NEW ITEM APPEARING ON ANY LIST FOR FIRST TIME.


ANT RECEPT
2UV 400∿ FOR 1 WATT 1000KC
Q1 M25 RF AMP
20UV @ 400∿ (262.5KC) FOR 1 WATT
C1 150 to 290
L1
R2 220*
1.1V
8.4V
.45V
C2 330
R1 220
C4 180
L2
C3A 65 NOM
C7 250
R3 330*
C9 .01
R20 470K
C8 .01
R4 82K
2.4V
C5 .01
63
64
65
66
67
70
L1 L2 L3
(BOT VIEW)
L1, L2 & L3 CONNECTIONS
38
LEFT CHANNEL
15UV @ 400∿ FOR 1 WATT
Q4 M822 1ST TAPE PRE AMP
E7A
C20 20MF
RED.
ORG
.62V
1.4V
.046V
R21 82K
R23 120
C29 .0047
R36 39K
Q5 M54 2ND TAPE PRE AMP
C24 180
R25 27K
R27 1.5K
C27 80MF
R30 100
R33 6.8K
7.7V
.8V
C22 40MF
R31 1K
176 AMP
1.25V
13.8V
R68 .2
T3
ORG
C49 .01
E12
ORG
PRPL
WHT
TO SPEAKER SYSTEM
14.0V
L4
ON-OFF SW VOL. CONT
YEL-BLK STRIPE
+ 14.4V
BLK
"T" BIRD ONLY
R69 680
C55 .01
C50 1000MF
E9
RED
ORG
SHIELD
YEL
BLU
FRONT VIEW
TAPE HEAD CONN CABLE
E10
BLU-RED STRIPE
DIAL LIGHT LEAD
DIAL LIGHT
C56 .01
CAUTION
"A" LEAD MUST BE CONNECTED TO POSITIVE (+) SIDE OF POWER SUPPLY. RADIO WILL NOT OPERATE AND DAMAGE TO COMPONENTS WILL RESULT IF CONNECTED OTHERWISE.
RIGHT CHANNEL
Q6 M822 1ST TAPE PRE AMP
E7B
C21 20MF
YEL
BLU
R22 82K
R24 120
C28 .0047
R35 39K
Q7 M54 2ND TAPE PRE AMP
C25 180
R26 27K
R28 1.5K
C26 80 MF
R29 100
R34 6.8K
C23 40MF
R32 1K
13 176 AMP
R67 .2
T4
WHT
C54 .01
DIAG. 63D43301A27-0-SPCL
(BOT VIEW) TRANSISTOR CONN
(BOT VIEW) C3 CONN
WIDE LUG
(BOT VIEW) T1 & T2 CONN
(BOT VIEW) Q11, 15 & 16 CONN
PLATED BOARD WIRING LEGEND
■■, ■ = B+ ▛ = RF AVC ▛▛ = IF AVC

Ref. No.	Part Number	Description	List Price
TRANSISTORS			
Q-4	48S134823	M822	1.50
Q-5	48S134673	M54 (USE 48S134810)	1.60
Q-6	48S134823	M822	1.50
Q-7	48S134673	M54 (USE 48S134810)	1.60
Q-14	48S134930	P1E	
		MECHANICAL PARTS	
2	26B40399B01	SHIELD, motor mtg	1.45
3	7A43576A01	SUPPORT, motor: rubber	.15
4	---	SEE E-3 IN ELECTRICAL PARTS	
5	7A43576A01	SUPPORT, motor: rubber	.15
6	55B40606B01	PAWL, pull ratchet: "B"	.10
7	22B43667A04	PIN, spiral: solenoid plunger	.05
8	---	SEE E-6 IN ELECTRICAL PARTS	
11	4C40104A14	WASHER, spring: solenoid stop	.10
12	2S8357	NUT, hex: 5/16-32 (to secure solenoid stop)	.10
13	46A40299B01	STOP, solenoid	1.20
15	*41B41716B02	SPRING, plunger return	
16	47A40298B01	PLUNGER, solenoid	1.20
17	55B40605B01	PAWL, push ratchet: "A"	.10
18	3K564805	SCREW, spcl: transistor mtg	.03
19	3K564805	SCREW, spcl: transistor mtg	.03
20	---	SEE Q-14 IN ELECTRICAL PARTS	
21	14A543810	INSULATOR, transistor	.10
23	9C43089A02	SOCKET, transistor (USE 9C43089A01)	.25
25	41B41251B01	SPRING, cam tension	.03
26	47B40414B01	SHAFT, cam	1.15
38	1V41001B18	SPRING & ROLLER ASSEM: cartridge: incl items 36-40	.60
39	49A43658A03	ROLLER, cartridge ret: solid metal (cartridge spring-in some sets)	.25
	49A41281B01	ROLLER, cartridge ret: drilled (cartridge spring-in some sets)	.20
40	22C42038A05	PIN, drive: cartridge tension spring	.05
41	---	SEE E-8 IN ELECTRICAL PARTS	
42	45B40495B01	CAM, switch: tape-radio	.30
43	4C40246A08	WASHER, "C"	.03
45	2S7007	NUT, hex: 8-32 x 1/4 (to secure cam shaft)	.03
46	4C40539B01	WASHER, "C": ext (flywheel shaft-to retain thrust washers & bearings)	.03
47	4A40409B01	WASHER, thrust: flywheel shaft	.10
48	43B40411B02	BEARING, thrust: capstan shaft	.25
49	4A40409B01	WASHER, thrust: flywheel shaft	.10
50	4C40538B01	WASHER, "C": int (to secure flywheel shaft)	.03
51	47P40059A45	SHAFT, capstan: incl item 52	2.10
52	43A43867A01	BEARING, nylon: capstan shaft	.05
53	15P40059A44	CAPSTAN HSG ASSEM	4.90
54	41A40444B01	SPRING, azimuth tension	.05
55	3S129610	SCREW, mach: 4-40 x 1; sl rnd hd (azimuth adjust)	.03
56	14A40452B01	INSULATOR, micro sw	.05
57	---	SEE E-14 IN ELECTRICAL PARTS	
58	45B40480B01	ARM, micro-sw act	.25
59	3S135649	SCREW, tpg: 2-56 x 1/2; phl rnd hd (micro sw mtg).	.05
60	3S135649	SCREW, tpg: 2-56 x 1/2; phl rnd hd (micro sw mtg).	.05
61	64P40059A47	TAPE GUIDE BRACKET: incl items 62 & 64	1.10
61A	46B41160B01	STOP, tape	
63	3S132752	SCREW, mach: 4-40 x 1-7/16; pln hex (tape guide brkt).	.05
65	3S132645	SCREW, mach: 4-40 x 7/32 (act arm ret)	.03
66	26A40607B01	RETAINER, actuating arm	.05
67	43A41239B01	SPACER, tape guide bracket.	.40
68	45A41230B01	ARM, radius: right	.15
69	42A41229B01	CLIP, spring: radius arms retaining	.15
70	45A41231B01	ARM, radius: left	.15
71	3S135915	SCREW, mach: 4-40 x 3/8; phl rnd hd (head mtg-in some sets)	.05
72	3S9718	SCREW, set: 4-40 x 1/8 (head mtg-in some sets)...	.10
73	---	SEE E-7 IN ELECTRICAL PARTS	
74	46P40059A46	RETAINER, stereo hd: incl pin	1.50
75	41A40540B01	SPRING, head tension	.20
76	---	SEE E-9 IN ELECTRICAL PARTS	
77	45A41231B01	ARM, radius: left	.15
78	45A41230B01	ARM, radius: right	.15
79	42A41229B01	CLIP, spring: radius arms retaining	.15
80	---	SEE E-5 IN ELECTRICAL PARTS	
82	49A43659A02	ROLLER, deck slide: plastic	.40
83	22B43667A03	PIN, spiral: deck slide roller	.05
84	84D43709A03	BOARD, plated chassis: pre-amp; less all components..	1.75
93	2S131435	NUT, hex: 4-40 x 1/4 (to secure tape guide bracket.	.10
94	41A40681B01	SPRING, pawl tension	.25
95	45C40428B01	CAM, head positioning	1.75
96	4A40409B03	WASHER, thrust: .126 x .50 (cam shaft)	.10
97	43B40411B01	BEARING, thrust: cam shaft.	.25
98	4A40409B02	WASHER, thrust: .126 x .312 (cam shaft)	.10
99	4C40246A08	WASHER, "C"	.03
100	49C40416B02	FLYWHEEL	3.95
101	3S124763	SCREW, mach: 6-32 x 1/4; phl trs hd (flywheel mtg)	.05
103	42B40426B01	BELT, drive	.70

Ref. No.	Part Number	Description	List Price
	ACCESSORY SERVICE AIDS & TOOLS		
	99P43309A01	CARTRIDGE, test tape	
	*68P40059A33	DISC, strobe (flywheel	
	11M490487	GREASE, silicon	
	*11P40059A55	GREASE, special,lightweight low temperature type	
	*66T40059A54	PLIERS, tru-arc (for removing item 46)	

*DENOTES NEW ITEM APPEARING ON ANY LIST FOR FIRST TIME.


ANT RECEPT
2UV 400% FOR 1 WATT 1000KC
Q1 M25 RF AMP
20UV @ 400% (262.5KC) FOR 1 WATT
Q2 25A CONV
1.5KUV @ 400% (262.5KC) FOR 1 WATT
Q3 M24 IF AMP
T1
T2
E2 1N461
E1 1N461
MICRO SW E14
SW ACTIVATED WITH CARTRIDGE PUSH IN
E6 SOLENOID FOR DETENTING HEAD
Q14 P1E REGULATOR
MOTOR E3
GOVERNOR
E5
NORMALLY OPEN SW ON VOL TONE SHAFT
CONTACTS FOR AUTOMATIC DETENTING
E13
L1 L2&L3 CONNECTIONS
(BOT VIEW)
LEFT CHANNEL
RIGHT CHANNEL
15UV @ 400% FOR 1 WATT
Q4 M822 1ST TAPE PRE AMP
Q5 M54 2ND TAPE PRE AMP
Q6 M822 1ST TAPE PRE AMP
Q7 M54 2ND TAPE PRE AMP
E7A
E7B
E9
FRONT VIEW TAPE HEAD CONN CABLE
E8
IN SOME SETS
.003 R.M.S. FOR 1 WATT @ 400%
TONE
VOLUME
BAL
Q8 M54 PRE-DRIVER
Q9 M54 DRIVER
Q10 2N176 PWR AMP
Q11 M54 PRE-DRIVER
Q12 M54 DRIVER
Q13 2N176 PWR AMP
T3
T4
E12
TO SPEAKER SYSTEM
ON-OFF SW VOL. CONT
YEL-BLK STRIPE
+ 14.4V
BLK "F" BIRD ONLY
E10
BLU-RED STRIPE
DIAL LIGHT LEAD
DIAL LIGHT
DIAG. 63D43301A27-0-SPCL
(BOT VIEW) Q17 CONN
(BOT VIEW) TRANSISTOR CONN
(BOT VIEW) C3 CONN
WIDE LUG
(BOT VIEW) T1 & T2 CONN
(BOT VIEW) Q11, 15 & 16 CONN

AVC VOLTAGE CHECK

RF INPUT	RF AVC	IF AVC
NO SIGNAL IN	+1.1V	+.8V
100UV	+.65V	+.17V
10KUV	+.48V	-.04V
1V	-.95V	-1.7V

@ 400HZ, 30% MOD. 1-WATT OUTPUT

PLATED BOARD WIRING LEGEND

■■, ■ = B+ ▛ = RF AVC ▛▛ = IF AVC

NOTES:

CAPACITORS - UNLESS OTHERWISE SPECIFIED DECIMAL VALUES IN MF. ALL OTHERS IN MMF.
VOLTAGES - MEASURED FROM POINT INDICATED TO CHASSIS WITH A VTVM. ± 10% NO SIGNAL INPUT.

*THE EXACT VALUE TO BE DETERMINED BY PRODUCTION PROCESS. REPLACE WITH THE SAME VALUE OF THE ORIGINAL PART.

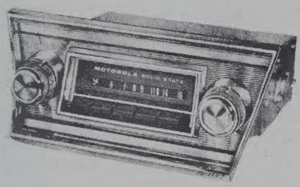
TUNING RANGE - 530 TO 1610KC
INPUT VOLTAGE - 14.4V DC
IF FREQ - 262.5KC

CAUTION

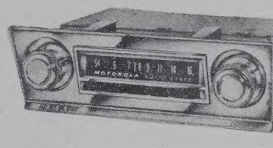
"A" LEAD MUST BE CONNECTED TO POSITIVE (+) SIDE OF POWER SUPPLY. RADIO WILL NOT OPERATE AND DAMAGE TO COMPONENTS WILL RESULT IF CONNECTED OTHERWISE.

MODELS CE67A, CO67A, CR67A, CT67A, CY67A, PT67A, TM7A, KM15S, KM19S

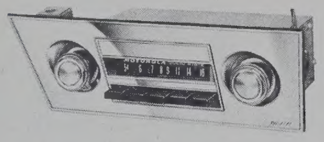
MOTOROLA service manual

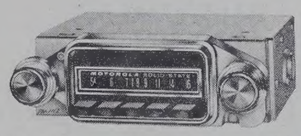

MODEL CE67A

MODEL CO67A


MODEL CR67A

MODEL CT67A


MODEL CY67A


MODEL PT67A

MODEL TM7A

GENERAL INFORMATION

Automotive type all-transistor superheterodyne AM radios for standard broadcast reception; these receivers operate from 12 volt negative ground systems. Designed for custom installation in the following cars:

Model CE67A - 1967 Chevelle

Model CO67A - 1967 Camaro

Model CR67A - 1967 Corvair

Model CT67A - 1967 Chevrolet

Model CY67A - 1967 Chevy II

Model PT67A - 1967 Tempest

Model TM7A - Universal type capable of installation in many vehicles (cars, trucks, boats, etc.) by using the AK-223, AK-230 or KM35T trimplate kits. The control shaft spacing can be adjusted to match the hole spacing in the dash panel (see "Radio Installation Detail").

These receivers contain 6 transistors, 2 diodes, 1 Zener diode and use 8 ohm speaker systems.

Models KM15S and KM19S are rear speaker kits for the models having a built-in rear speaker control.

SERVICE NOTES

1. Make certain the "A" lead is connected to the positive (+) side of the power source, otherwise, damage to receiver may result. If a battery eliminator is used as a power source in place of a battery, it must be well filtered and regulated.

2. When replacing a power output transistor, remember to use the transistor specified in the parts list; coat both sides of the transistor insulator with DC-4 grease (Motorola Part No. 11M490487) and securely tighten the transistor mounting screws. When replacing all other transistors, use long-nose pliers as a heat sink, i.e., grasp transistor leads close to transistor base with the pliers to dissipate heat while soldering.

3. The plated chassis used in these receivers have plating on both sides; the exposed side (opposite components) contains the actual circuitry while the plating on the component side contains primarily B- points.

Servicing techniques applicable to these models can be found in the following Motorola publications: "Profitable Transistor Radio Servicing" (Motorola Part Number 68P60011A53) and "A Discussion Of Transistorized Car Radios" (Motorola Part No. 68P64980A51).

4. REAR SPEAKERS - MODELS CE67A, CO67A, CT67A and PT67A - The KM15S (6" x 9" - 8 ohm) or KM19S (6" - 8 ohm) rear speaker kits can be used with these models.

REAR SPEAKER - MODEL TM7A - The KM8S (6" x 9" - 8 ohm with fader control) rear speaker kit can be used with this model.

TO SET PUSHBUTTONS

Unlock pushbutton by pulling it out about 1/2" forward of its normal position. Tune in station and lock the pushbutton to the station by pushing it in firmly.

auto radio MANUAL 68P64994A58
MODELS CE67A, CO67A, CR67A, CT67A, CY67A,
PT67A, TM7A, KM15S, KM19S

MOTOROLA INC. 9401 WEST GRAND AVENUE, FRANKLIN PARK, ILLINOIS
PART NO. 68P64994A58 1-67 PRICE 35 CENTS
COPYRIGHT 1967 BY MOTOROLA INC. - PRINTED IN U.S.A.

MOTOROLA AUTO RADIO WARRANTY SERVICE STATION PROCEDURE

1. A Motorola Branded Model is one that has the Motorola name and is distributed to dealers through the Motorola Distributor.

2. These models are guaranteed for all parts and labor, including removal and re-installation (R & R), for a period of two years from the date of purchase. The following repairs are not covered under this guarantee: the elemination of motor noise, tire static, electrical interference and faulty installation. Charges for these repairs are to be paid by the customer.

3. Before performing a guarantee repair on a Motorola Branded Auto Radio, you must first receive the Customer's Car Radio Guarantee and Service Booklet. The installation and model information on the booklet must be filled in by the selling dealer at the time of retail sale. The Customer's Car Radio Guarantee and Service Booklet must show that the radio is within the guarantee period to be repaired under the Motorola Auto Radio Guarantee.

4. To obtain your labor allowance for the servicing of the customers in-guarantee set, fill in the Motorola Guarantee Labor Claim, Part No. 68P60016A30. If you perform a R & R service, you are entitled to the R & R allowance. If you only repair the radio without R & R service, you are entitled to the labor allowance. However, if you perform both R & R and the repair, then be sure to indicate both on your claim form for both allowances. After the form has been filled in, mail the pink and green copies to your Motorola Distributor for payment. The yellow copy is to be retained in the Service Station file.

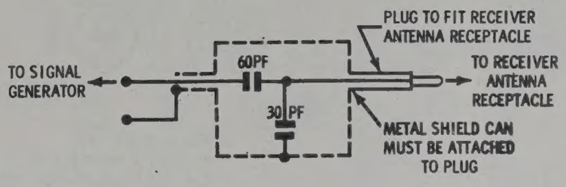
5. Defective parts for guarantee repairs made are to be sent to your Motorola Distributor for free replacement supported with the defective parts return tag, Part Number 54P591808.

6. Only those service stations authorized by their Motorola Distributor can perform repairs within the guarantee period on a no-charge basis to the customer. If you are not an Authorized Motorola Auto Radio Service Station and you are interested in handling this service, please contact your Motorola Distributor for complete details.

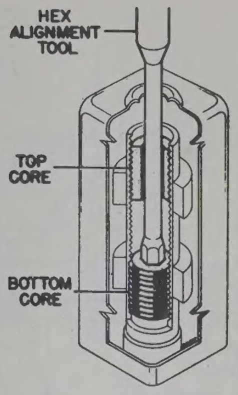
ALIGNMENT

Connect an output meter across the speaker voice coil. Set volume to maximum and tone to treble. Attenuate signal generator output to maintain 1 watt (2.8 volts across an 8 ohm load) on output meter at all times.

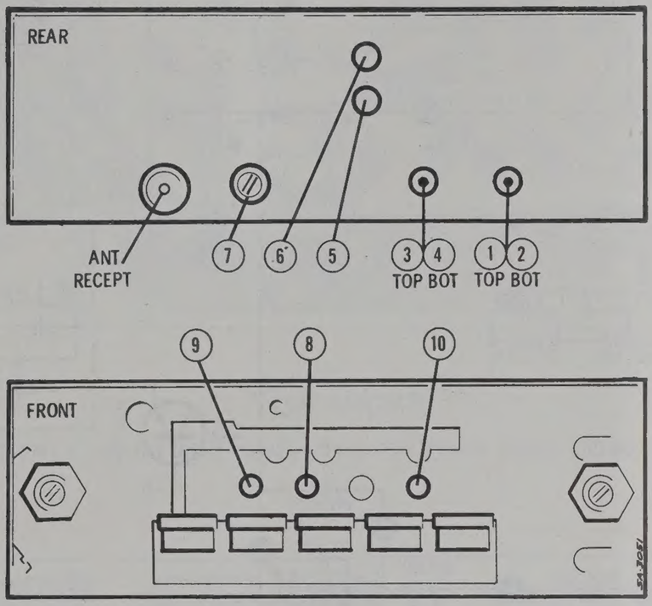
STEP	GENERATOR CONNECTION	GENERATOR FREQUENCY (40 cycle 30% mod)	TUNER SET TO	ADJUST	REMARKS
IF ALIGNMENT					
1.	To collector of RF amplifier thru .1mf and chassis	262.5Kc	Hi end stop	1, 2, 3 & 4	Adjust for maximum.
RF ALIGNMENT					
2.	Antenna receptacle thru dummy (see Figure)	1610Kc	Hi end stop	5, 6 & 7	Adjust for maximum.
NOTE:	Do not perform Steps #3, #4, #5 and #6 unless the tuner has been tampered with or associated components have been replaced. If necessary, remove the escutcheon, dial background and the pilot light socket to expose the core screws. Before proceeding with Step #3, back the tuning cores as far as possible out of the coils to eliminate their effect on trimmer adjustments.				
3.	Antenna receptacle thru dummy (see Figure)	1610Kc	Hi end stop	5, 6 & 7	Adjust for maximum.
4.	"	1200Kc	Tuner carriage 9/16" from hi end stop	8, 9 & 10	Adjust for maximum.
5.	"	1610Kc	Hi end stop	5, 6 & 7	Adjust for maximum.
6.	Repeat Steps #4 and #5 until no further increase; Step #5 should be last step. Then cement core screws in place.				
ANTENNA TRIMMER					
7.	---	---	Weak station around 1400Kc	7	Adjust for maximum with car radio installed in car and antenna fully extended.


PLUG TO FIT RECEIVER ANTENNA RECEPTACLE
TO SIGNAL GENERATOR
60PF
30 PF
TO RECEIVER ANTENNA RECEPTACLE
METAL SHIELD CAN MUST BE ATTACHED TO PLUG

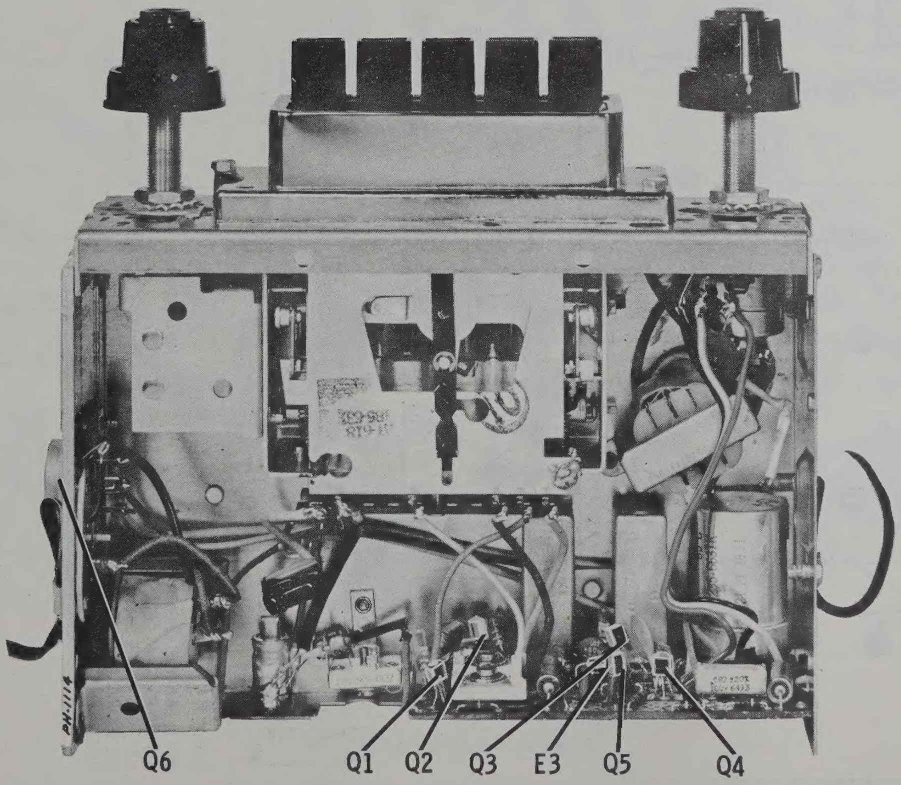
DUMMY ANTENNA DETAIL


HEX ALIGNMENT TOOL
TOP CORE
BOTTOM CORE

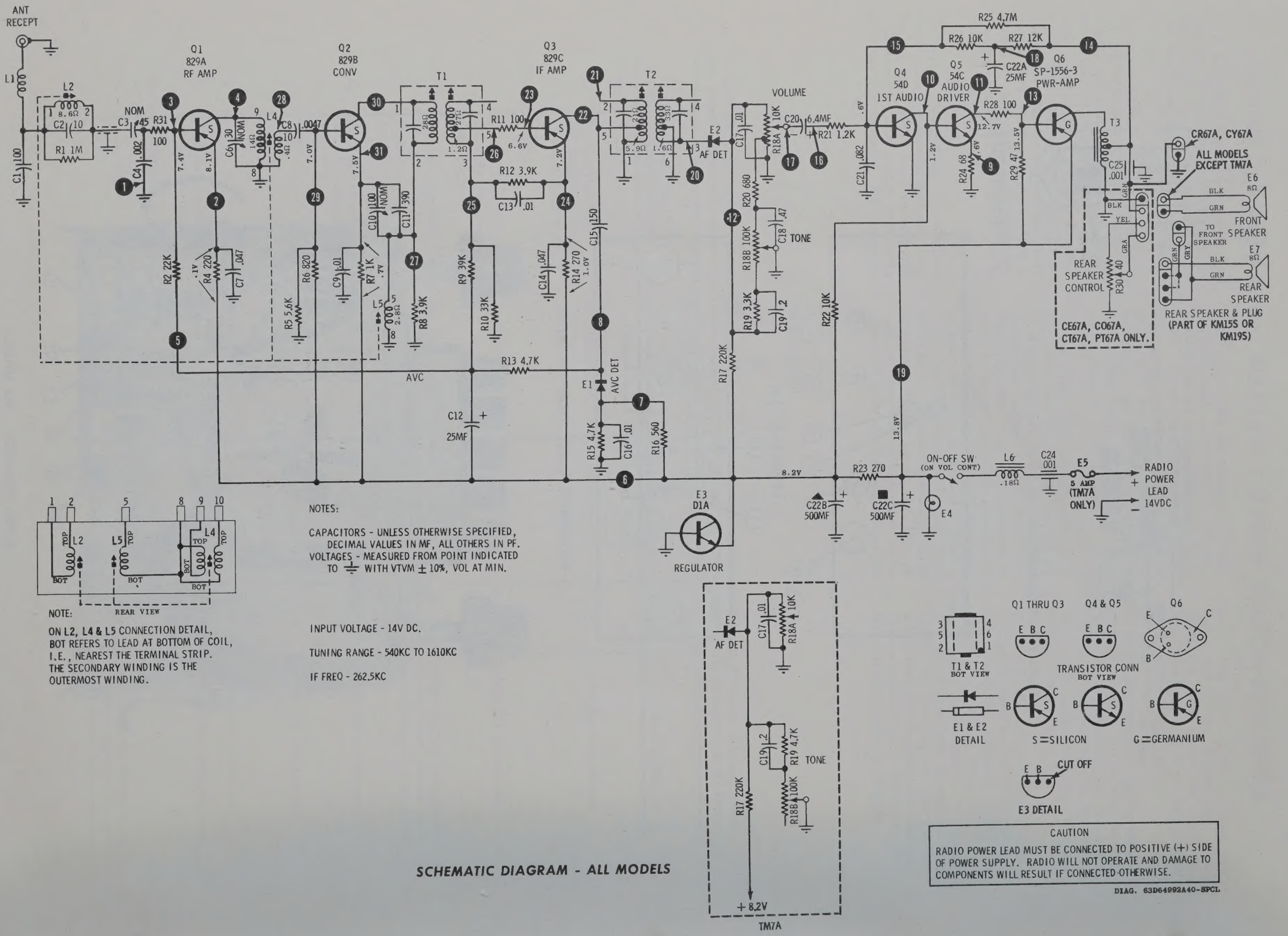
IF ALIGNMENT DETAIL


REAR
ANT RECEPT
7
6
5
3
4
TOP BOT
1
2
TOP BOT
9
8
10
FRONT
54-3051

ALIGNMENT POINTS LOCATION DETAIL


PH-1114
Q6
Q1
Q2
Q3
E3
Q5
Q4

PARTS LOCATION - ALL MODELS


ANT RECEPT
L1
C1 100
L2 8.6Ω
C2 10
R1 1M
NOM C3 45
C4 .002
R31 100
Q1 829A RF AMP
7.4V
8.1V
R2 22K
R4 220
.1V
C7 .047
C6 30 NOM
L4 14Ω .4Ω
C8 10
.0047
Q2 829B CONV
7.0V
7.5V
R6 820
R5 5.6K
C9 .01
R7 1K
.7V
C10 100 NOM
C11 390
L5 2.8Ω
R8 3.9K
T1 28Ω 27Ω 1.2Ω
R11 100
6.6V
Q3 829C IF AMP
7.2V
R12 3.9K
C13 .01
R9 39K
R10 33K
C14 .047
R14 270
1.0V
C15 150
R13 4.7K
AVC
C12 25MF
E1 AVC DET
R15 4.7K
C16 .01
R16 560
T2 21Ω 33Ω 5.9Ω 1.6Ω
E2 AF DET
VOLUME
C17 .01
R18A 10K
R20 680
C18 .47
TONE
R18B 100K
R19 3.3K
C19 .2
R17 220K
C20 6.4MF
R21 1.2K
C21 .082
.6V
Q4 54D 1ST AUDIO
1.2V
Q5 54C AUDIO DRIVER
12.7V
.6V
R24 68
R28 100
R26 10K
R25 4.7M
R27 12K
C22A 25MF
Q6 SP-1556-3 PWR-AMP
13.5V
R29 47
R22 10K
13.8V
T3
C25 .001
CR67A, CY67A
ALL MODELS EXCEPT TM7A
E6 8Ω
BLK
GRN
FRONT SPEAKER
TO FRONT SPEAKER
GRY
E7 8Ω
REAR SPEAKER
REAR SPEAKER & PLUG (PART OF KM15S OR KM19S)
YEL
GRA
REAR SPEAKER CONTROL
R30 40
CE67A, CO67A, CT67A, PT67A ONLY.
8.2V
R23 270
C22B 500MF
C22C 500MF
E4
ON-OFF SW (ON VOL CONT)
L6 .18Ω
C24 .001
E5 5 AMP (TM7A ONLY)
RADIO POWER LEAD 14VDC
E3 D1A REGULATOR
TOP
BOT
REAR VIEW
+8.2V
TM7A
Q1 THRU Q3
Q4 & Q5
Q6
E B C
T1 & T2 BOT VIEW
TRANSISTOR CONN BOT VIEW
E1 & E2 DETAIL
S=SILICON
G=GERMANIUM
CUT OFF
E3 DETAIL

NOTE:

ON L2, L4 & L5 CONNECTION DETAIL, BOT REFERS TO LEAD AT BOTTOM OF COIL, I.E., NEAREST THE TERMINAL STRIP. THE SECONDARY WINDING IS THE OUTERMOST WINDING.

NOTES:

CAPACITORS - UNLESS OTHERWISE SPECIFIED, DECIMAL VALUES IN MF, ALL OTHERS IN PF.
VOLTAGES - MEASURED FROM POINT INDICATED TO ⏚ WITH VTVM ± 10%, VOL AT MIN.

INPUT VOLTAGE - 14V DC.

TUNING RANGE - 540KC TO 1610KC

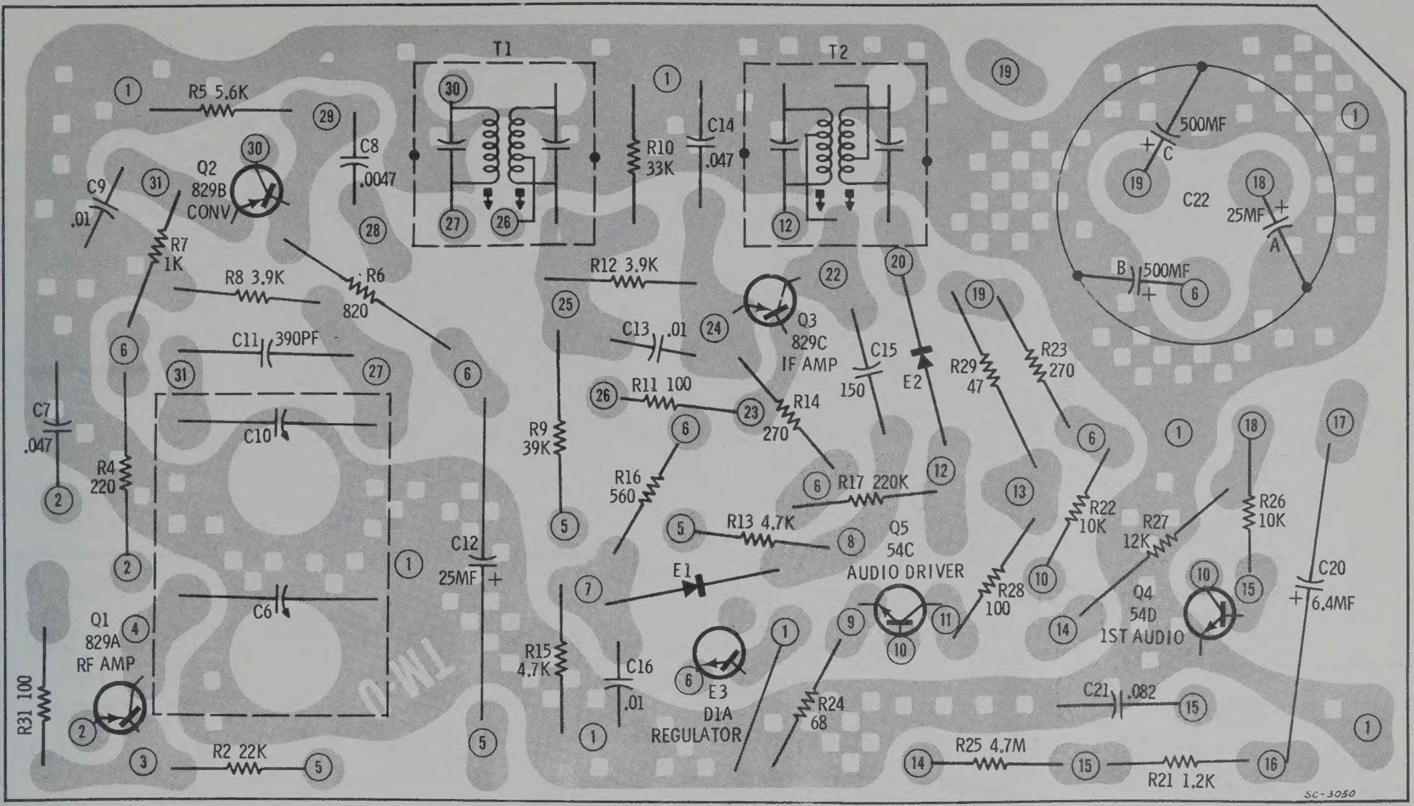
IF FREQ - 262.5KC

SCHEMATIC DIAGRAM - ALL MODELS

CAUTION

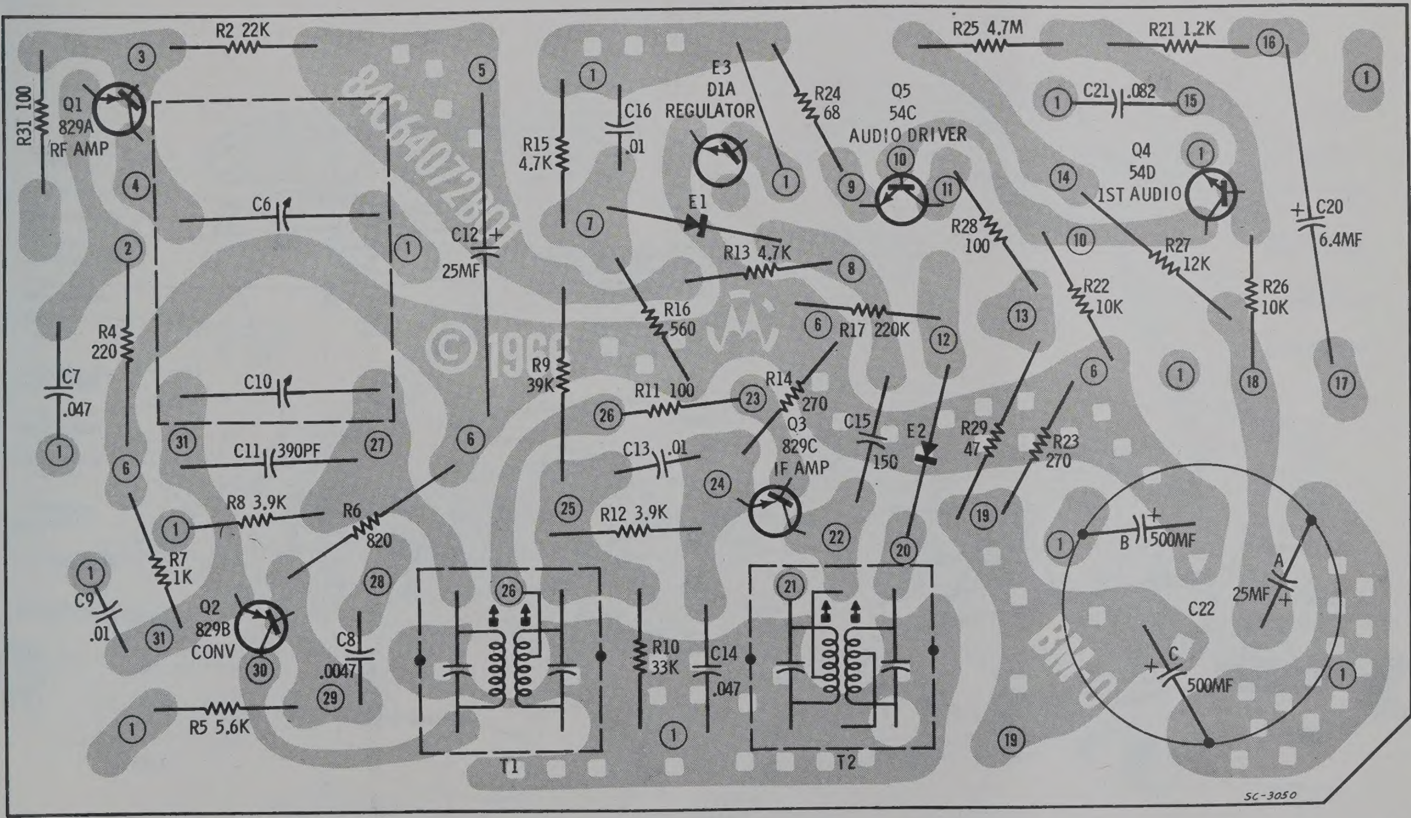
RADIO POWER LEAD MUST BE CONNECTED TO POSITIVE (+) SIDE OF POWER SUPPLY. RADIO WILL NOT OPERATE AND DAMAGE TO COMPONENTS WILL RESULT IF CONNECTED OTHERWISE.

DIAG. 63D64992A40-SPCL


T1
T2
R5 5.6K
Q2 829B CONV
C8 .0047
C9 .01
R7 1K
R8 3.9K
R6 820
C11 390PF
C10
C6
C7 .047
R4 220
C12 25MF
Q1 829A RF AMP
R31 100
R2 22K
R10 33K
C14 .047
R12 3.9K
C13 .01
Q3 829C IF AMP
R11 100
R14 270
R9 39K
R16 560
R13 4.7K
R17 220K
E1
C15 150
E2
R29 47
R23 270
Q5 54C AUDIO DRIVER
R28 100
R24 68
E3 D1A REGULATOR
C16 .01
R15 4.7K
C22
C 500MF
A 25MF
B 500MF
R22 10K
R27 12K
R26 10K
Q4 54D 1ST AUDIO
C20 6.4MF
C21 .082
R25 4.7M
R21 1.2K
TM-0
SC-3050

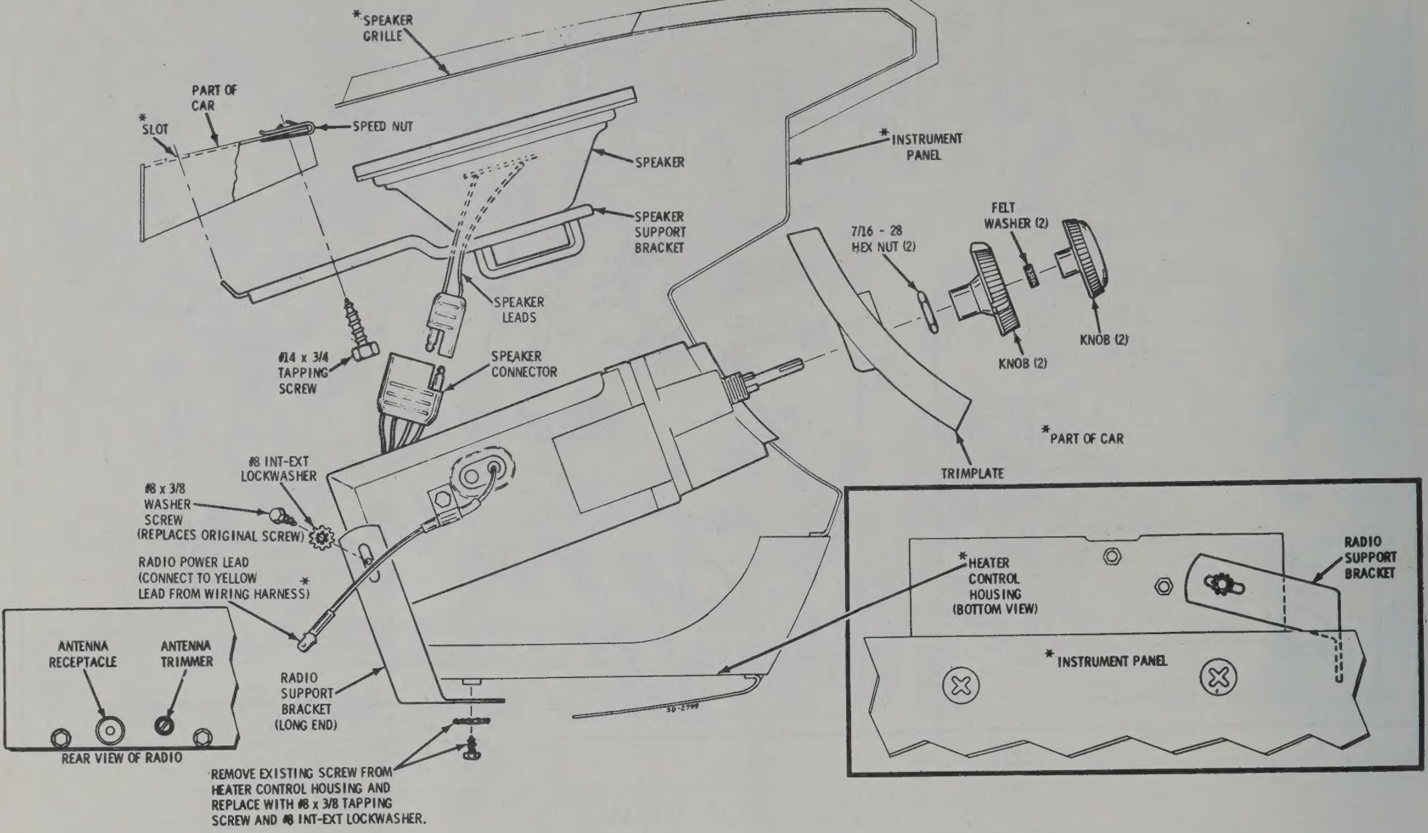
TOP VIEW

PLATED CHASSIS REFERENCE POINTS AND PARTS LOCATION (VIEW FROM COMPONENT SIDE OF BOARD)

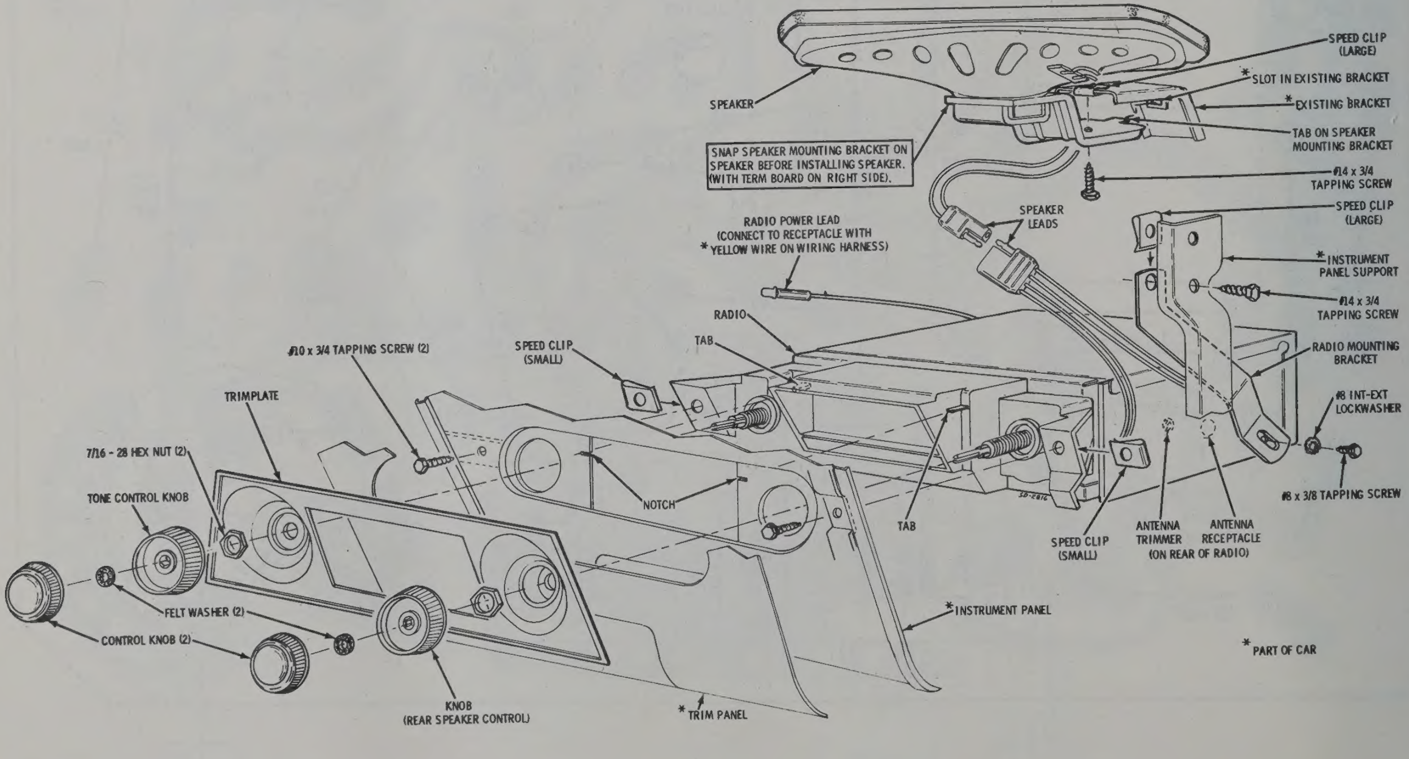

R2 22K
Q1 829A RF AMP
R31 100
C6
C10
C11 390PF
C7 .047
R4 220
R8 3.9K
R6 820
R7 1K
C9 .01
Q2 829B CONV
C8 .0047
R5 5.6K
T1
C12 25MF
R15 4.7K
C16 .01
E3 D1A REGULATOR
R24 68
Q5 54C AUDIO DRIVER
E1
R13 4.7K
R16 560
R17 220K
R9 39K
R11 100
R14 270
Q3 829C IF AMP
C13 .01
R12 3.9K
C15 150
E2
R10 33K
C14 .047
T2
R25 4.7M
R21 1.2K
C21 .082
Q4 54D 1ST AUDIO
C20 6.4MF
R28 100
R27 12K
R22 10K
R26 10K
R29 47
R23 270
B 500MF
A 25MF
C22
C 500MF
©1966
BM-0
SC-3050

BOTTOM VIEW

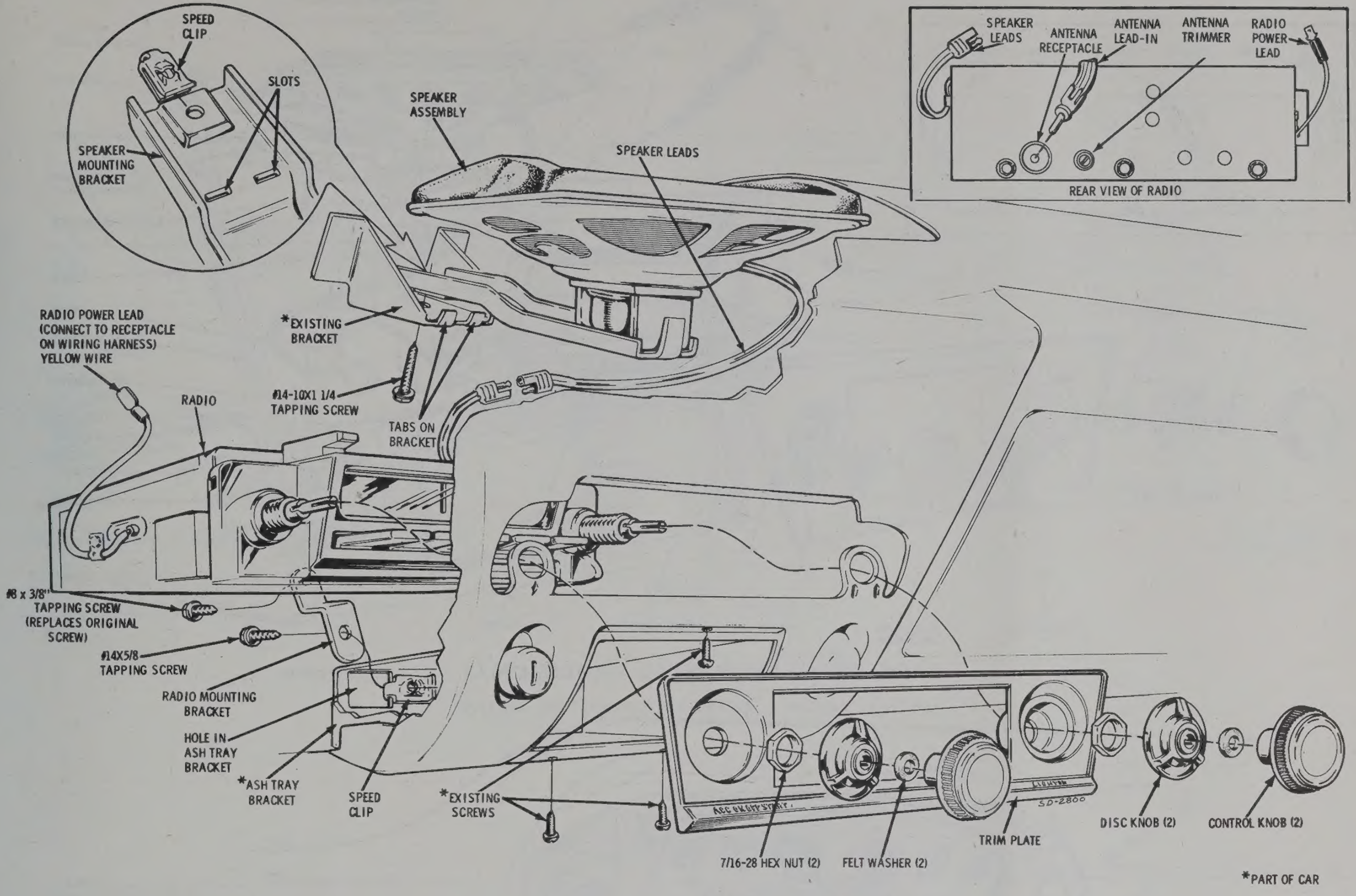
PLATED CHASSIS REFERENCE POINTS AND PARTS LOCATION (VIEW FROM WIRING SIDE OF BOARD)


*SPEAKER GRILLE
PART OF CAR
*SLOT
SPEED NUT
SPEAKER
*INSTRUMENT PANEL
SPEAKER SUPPORT BRACKET
FELT WASHER (2)
7/16 - 28 HEX NUT (2)
SPEAKER LEADS
#14 x 3/4 TAPPING SCREW
SPEAKER CONNECTOR
KNOB (2)
KNOB (2)
*PART OF CAR
#8 INT-EXT LOCKWASHER
TRIMPLATE
#8 x 3/8 WASHER SCREW (REPLACES ORIGINAL SCREW)
RADIO SUPPORT BRACKET
*HEATER CONTROL HOUSING (BOTTOM VIEW)
RADIO POWER LEAD (CONNECT TO YELLOW LEAD FROM WIRING HARNESS) *
*INSTRUMENT PANEL
ANTENNA RECEPTACLE
ANTENNA TRIMMER
REAR VIEW OF RADIO
RADIO SUPPORT BRACKET (LONG END)
REMOVE EXISTING SCREW FROM HEATER CONTROL HOUSING AND REPLACE WITH #8 x 3/8 TAPPING SCREW AND #8 INT-EXT LOCKWASHER.

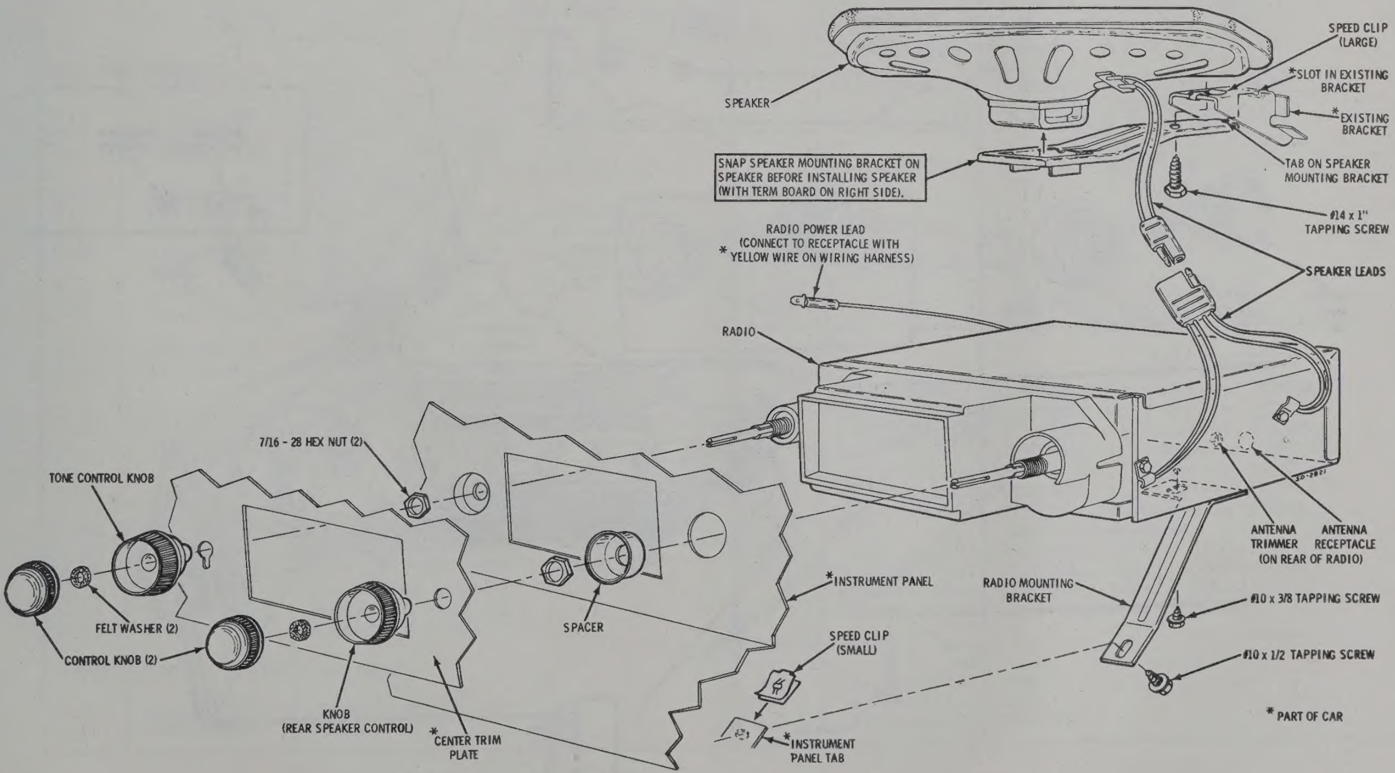
RADIO INSTALLATION DETAIL MODEL CE67A


SPEED CLIP (LARGE)
*SLOT IN EXISTING BRACKET
SPEAKER
*EXISTING BRACKET
TAB ON SPEAKER MOUNTING BRACKET
SNAP SPEAKER MOUNTING BRACKET ON SPEAKER BEFORE INSTALLING SPEAKER. (WITH TERM BOARD ON RIGHT SIDE).
#14 x 3/4 TAPPING SCREW
SPEAKER LEADS
SPEED CLIP (LARGE)
RADIO POWER LEAD (CONNECT TO RECEPTACLE WITH *YELLOW WIRE ON WIRING HARNESS)
*INSTRUMENT PANEL SUPPORT
#14 x 3/4 TAPPING SCREW
RADIO
TAB
#10 x 3/4 TAPPING SCREW (2)
SPEED CLIP (SMALL)
RADIO MOUNTING BRACKET
TRIMPLATE
#8 INT-EXT LOCKWASHER
7/16 - 28 HEX NUT (2)
NOTCH
#8 x 3/8 TAPPING SCREW
TONE CONTROL KNOB
TAB
SPEED CLIP (SMALL)
ANTENNA TRIMMER
ANTENNA RECEPTACLE (ON REAR OF RADIO)
FELT WASHER (2)
*INSTRUMENT PANEL
CONTROL KNOB (2)
*PART OF CAR
KNOB (REAR SPEAKER CONTROL)
*TRIM PANEL

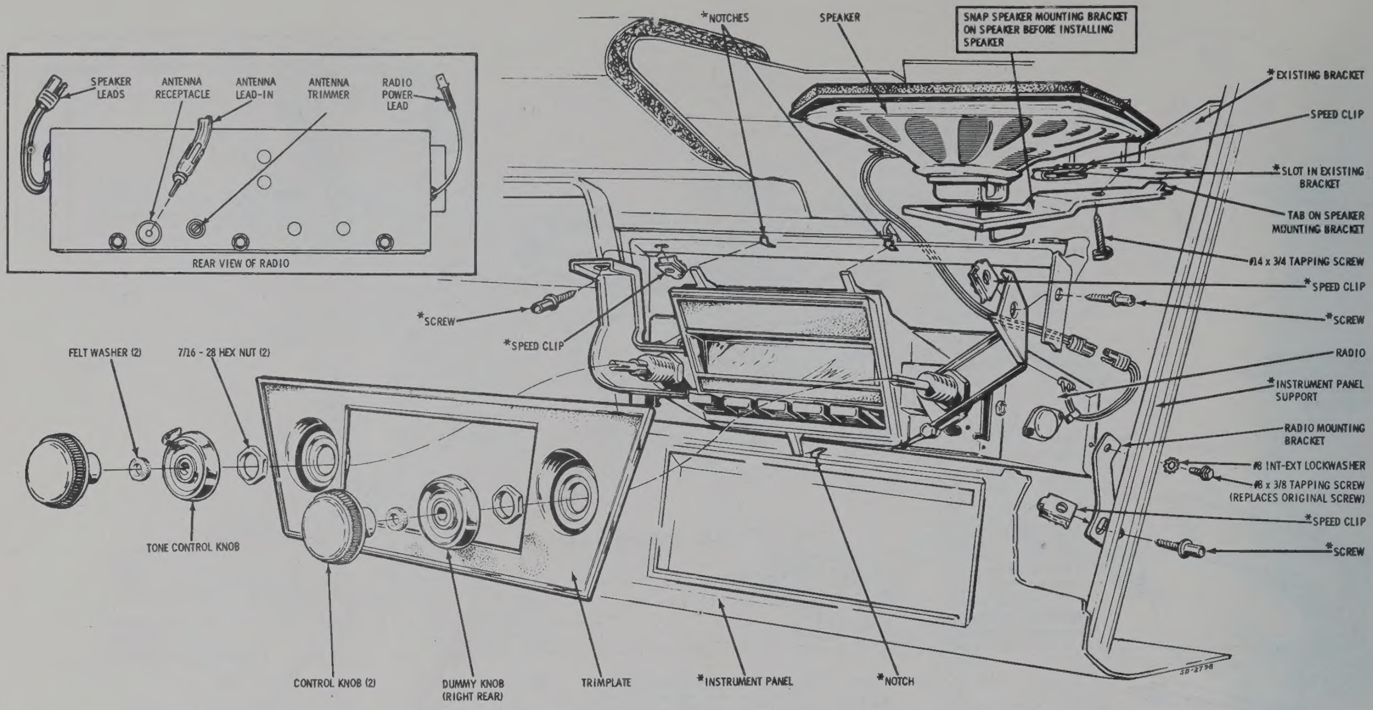
RADIO INSTALLATION DETAIL - MODEL CO67A


SPEED CLIP
SLOTS
SPEAKER MOUNTING BRACKET
SPEAKER ASSEMBLY
SPEAKER LEADS
SPEAKER LEADS
ANTENNA RECEPTACLE
ANTENNA LEAD-IN
ANTENNA TRIMMER
RADIO POWER LEAD
REAR VIEW OF RADIO
RADIO POWER LEAD (CONNECT TO RECEPTACLE ON WIRING HARNESS) YELLOW WIRE
*EXISTING BRACKET
RADIO
#14-10X1 1/4 TAPPING SCREW
TABS ON BRACKET
#8 x 3/8" TAPPING SCREW (REPLACES ORIGINAL SCREW)
#14X5/8 TAPPING SCREW
RADIO MOUNTING BRACKET
HOLE IN ASH TRAY BRACKET
*ASH TRAY BRACKET
SPEED CLIP
*EXISTING SCREWS
7/16-28 HEX NUT (2)
FELT WASHER (2)
TRIM PLATE
DISC KNOB (2)
CONTROL KNOB (2)
SD-2800
*PART OF CAR

RADIO INSTALLATION DETAIL - MODEL CR67A

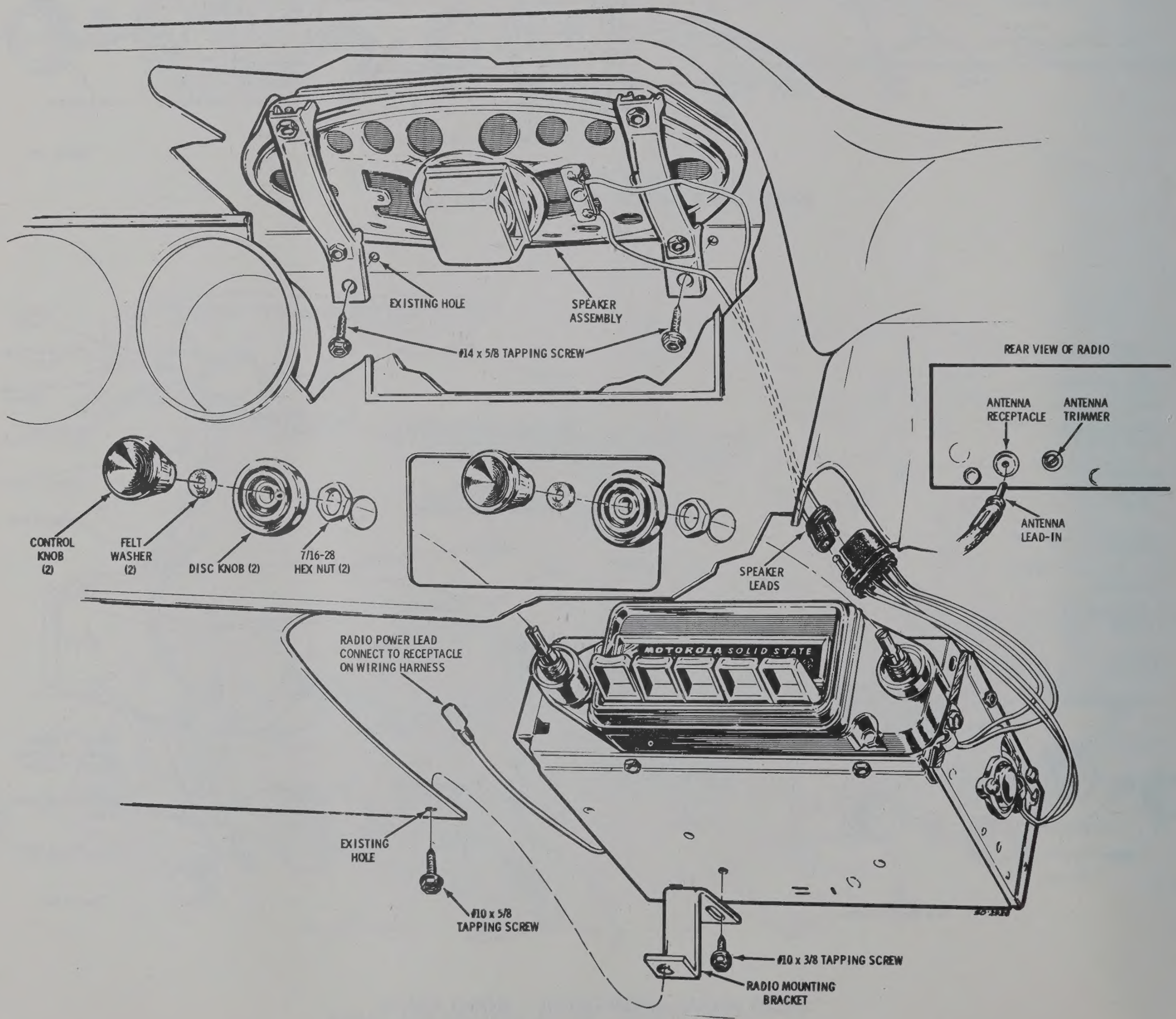

SPEED CLIP (LARGE)
*SLOT IN EXISTING BRACKET
*EXISTING BRACKET
SPEAKER
TAB ON SPEAKER MOUNTING BRACKET
SNAP SPEAKER MOUNTING BRACKET ON SPEAKER BEFORE INSTALLING SPEAKER (WITH TERM BOARD ON RIGHT SIDE).
#14 x 1" TAPPING SCREW
RADIO POWER LEAD (CONNECT TO RECEPTACLE WITH * YELLOW WIRE ON WIRING HARNESS)
SPEAKER LEADS
RADIO
7/16 - 28 HEX NUT (2)
TONE CONTROL KNOB
SD-2821
ANTENNA TRIMMER
ANTENNA RECEPTACLE (ON REAR OF RADIO)
*INSTRUMENT PANEL
RADIO MOUNTING BRACKET
#10 x 3/8 TAPPING SCREW
FELT WASHER (2)
SPACER
SPEED CLIP (SMALL)
#10 x 1/2 TAPPING SCREW
CONTROL KNOB (2)
KNOB (REAR SPEAKER CONTROL)
*CENTER TRIM PLATE
*INSTRUMENT PANEL TAB
* PART OF CAR

RADIO INSTALLATION DETAIL - MODEL CT67A

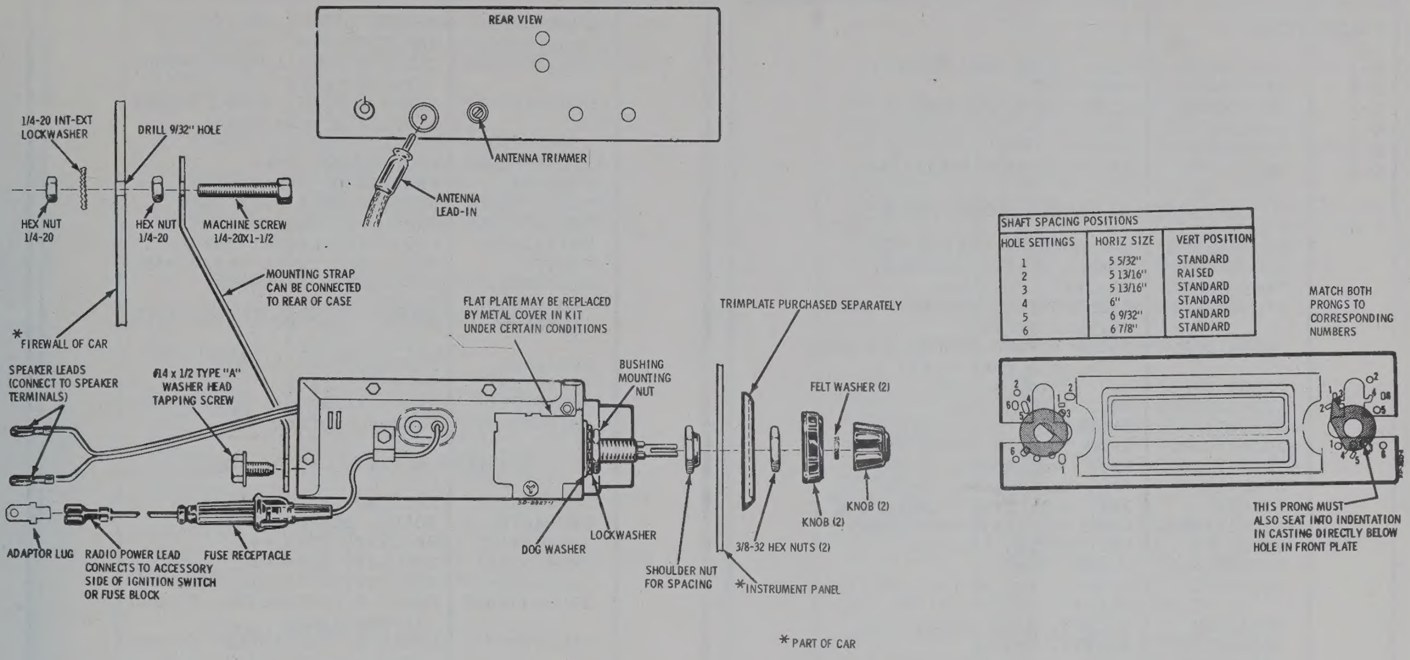

SPEAKER LEADS
ANTENNA RECEPTACLE
ANTENNA LEAD-IN
ANTENNA TRIMMER
RADIO POWER LEAD
REAR VIEW OF RADIO
*NOTCHES
SPEAKER
SNAP SPEAKER MOUNTING BRACKET ON SPEAKER BEFORE INSTALLING SPEAKER
*EXISTING BRACKET
SPEED CLIP
*SLOT IN EXISTING BRACKET
TAB ON SPEAKER MOUNTING BRACKET
#14 x 3/4 TAPPING SCREW
*SPEED CLIP
*SCREW
RADIO
*INSTRUMENT PANEL SUPPORT
RADIO MOUNTING BRACKET
#8 INT-EXT LOCKWASHER
#8 x 3/8 TAPPING SCREW (REPLACES ORIGINAL SCREW)
*SPEED CLIP
*SCREW
*SCREW
*SPEED CLIP
FELT WASHER (2)
7/16 - 28 HEX NUT (2)
TONE CONTROL KNOB
CONTROL KNOB (2)
DUMMY KNOB (RIGHT REAR)
TRIMPLATE
*INSTRUMENT PANEL
*NOTCH

RADIO INSTALLATION DETAIL - MODEL CY67A

*PART OF CAR


EXISTING HOLE
SPEAKER ASSEMBLY
#14 x 5/8 TAPPING SCREW
REAR VIEW OF RADIO
ANTENNA RECEPTACLE
ANTENNA TRIMMER
ANTENNA LEAD-IN
CONTROL KNOB (2)
FELT WASHER (2)
DISC KNOB (2)
7/16-28 HEX NUT (2)
SPEAKER LEADS
MOTOROLA SOLID STATE
RADIO POWER LEAD CONNECT TO RECEPTACLE ON WIRING HARNESS
EXISTING HOLE
#10 x 5/8 TAPPING SCREW
#10 x 3/8 TAPPING SCREW
RADIO MOUNTING BRACKET

RADIO INSTALLATION DETAIL - MODEL PT67A


REAR VIEW
ANTENNA TRIMMER
ANTENNA LEAD-IN
1/4-20 INT-EXT LOCKWASHER
DRILL 9/32" HOLE
HEX NUT 1/4-20
HEX NUT 1/4-20
MACHINE SCREW 1/4-20X1-1/2
MOUNTING STRAP CAN BE CONNECTED TO REAR OF CASE
*FIREWALL OF CAR
FLAT PLATE MAY BE REPLACED BY METAL COVER IN KIT UNDER CERTAIN CONDITIONS
TRIMPLATE PURCHASED SEPARATELY
SPEAKER LEADS (CONNECT TO SPEAKER TERMINALS)
#14 x 1/2 TYPE "A" WASHER HEAD TAPPING SCREW
BUSHING MOUNTING NUT
FELT WASHER (2)
KNOB (2)
KNOB (2)
ADAPTOR LUG
RADIO POWER LEAD CONNECTS TO ACCESSORY SIDE OF IGNITION SWITCH OR FUSE BLOCK
FUSE RECEPTACLE
DOG WASHER
LOCKWASHER
SHOULDER NUT FOR SPACING
3/8-32 HEX NUTS (2)
*INSTRUMENT PANEL
*PART OF CAR
MATCH BOTH PRONGS TO CORRESPONDING NUMBERS
THIS PRONG MUST ALSO SEAT INTO INDENTATION IN CASTING DIRECTLY BELOW HOLE IN FRONT PLATE

SHAFT SPACING POSITIONS

HOLE SETTINGS	HORIZ SIZE	VERT POSITION
1	5 5/32"	STANDARD
2	5 13/16"	RAISED
3	5 13/16"	STANDARD
4	6"	STANDARD
5	6 9/32"	STANDARD
6	6 7/8"	STANDARD

RADIO INSTALLATION DETAIL - MODEL TM7A

REPLACEMENT PARTS LIST

Ref. No.	Part Number	Description
	COMBINED ELECTRICAL PARTS	
CAPACITORS - NOTE:		The capacitors in this list are recommended replacement types for the original equipment; all are ceramic disc type unless otherwise specified.
C-1	8S10100A11	100 pf 10% 125V N150 polystyrene
C-2	21S124579	10 pf 10% 500V NPO FC
C-3	*20B64065B01	TRIMMER, 20-120 pf
C-4	8S10100A12	2000 pf 10% 125V N150 polystyrene (USE 8S10100A09)
C-6	*20C64618A04	DUAL TRIMMER
C-7	8S10192A03	.047 mf 20% 100V polyester
C-8	8S10192A01	.0047 mf 20% 100V polyester
C-9	8S10192A02	.01 mf 20% 100V polyester (USE 8C42750A06)
C-10	---	PART OF C6
C-11	8S10100A14	390 pf 5% 125V N150 polystyrene
C-12	23S187A02	25 mf 25V lytic
C-13	21S180C54	.01 mf +80-20% 100V (USE 21S132103)
C-14	8S10192A03	.047 mf 20% 100V polyester
C-15	21S132491	150 pf 10% 500V N750
C-16	21S180C54	.01 mf +80-20% 100V (USE 21S132103)
C-17	21S482726	.01 mf +100-0% 500V
C-18	21S10003A01	.47 mf +100-0% 3V
C-19	21S10003A08	.2 mf +80-20% 10V
C-20	23S187A01	6.4 mf 40V lytic
C-21	8S10192A04	.082 mf 20% 100V polyester
C-22	23S184A01	500-500-25 mf/16V lytic
C-24	21A560232	FEED-THRU capacitor
C-25	21A560232	FEED-THRU capacitor
MISCELLANEOUS ELECTRICAL PARTS		
E-1	48C134587	DIODE, 1N139
E-2	48C134587	DIODE, 1N139
E-3	*48S134912	ZENER DIODE: D1A
E-4	65S538410	BULB, dial: .11A - 14.4V; #1892
E-5	65S122345	FUSE, 5 amp: 1 AG 5 (TM7A)
E-6	1C64290A05	SPEAKER, 4 x 10 PM: 8Ω VC (CE67A & CY67A - USE 1C64290A04)
	*1D64324A03	SPEAKER, 6 x 9 PM: 8Ω VC (CR67A)
	*1C64290A04	SPEAKER, 4 x 10 PM: 8Ω VC (CT67A & CO67A)
	*50D64117B01	SPEAKER, 4 x 10 PM: 8Ω VC (PT67A)
	50C64137A01	SPEAKER, 5 x 7 PM: 8Ω VC (TM7A)
COILS & CHOKES		
L-1	*24C64003B02	CHOKE, ANT
L-2, L-4 & L-5	---	SEE TUNER PARTS
L-6	25C64172A05	CHOKE, filter (USE 25C64172A08)
CONTROLS		
R-18	18C64588A11	CONTROL, vol-tone-sw (CE67A)
	*18C64062A05	CONTROL, vol-tone-sw (CO67A)
	18C64588A06	CONTROL, vol-tone-sw (CR67A)
	*18C64062A04	CONTROL, vol-tone-sw (CT67A)
	18C64062A01	CONTROL, vol-tone-sw (CY67A)
	*18C64062A03	CONTROL, vol-tone-sw (PT67A)
	18C64668A03	CONTROL, vol-tone-sw (TM7A - USE 18C64668A02)
R-30	18B64440A07	CONTROL, fader (CE67A)
	*18B64100B03	CONTROL, fader (CO67A)
	*18B64100B01	CONTROL, fader (CT67A)
	*18B64100B02	CONTROL, fader (PT67A)
TRANSFORMERS		
T-1	24C64327A03	1ST IF
T-2	24C64327A02	2ND IF
T-3	25D64129A01	OUTPUT

Ref. No.	Part Number	Description
TRANSISTORS		
Q-1	48S134830	829A (USE 48S134831)
Q-2	48S134831	829B
Q-3	48S134832	829C (USE 48S134831)
Q-4	48S134811	54D
Q-5	48S134810	54C
Q-6	48S134760	SP1556-3 (USE 48S134759)
	MECHANICAL PARTS - MODEL CE67A	
	7B64035A01	BACKGROUND, dial scale
	84C64072B01	BOARD, plated chassis
	7B64033A01	BRACKET, dial ret
	30D64088B02	CABLE & PLUG ASSEM: 2-conn (front spkr)
	30D64120B01	CABLE & PLUG ASSEM: 4-conn (front & rear spkr)
	15D64068B01	COVER, top & back
	13D64048A01	ESCUTCHEON, dial
	14A543810	INSULATOR, transistor
	*36C64105B01	KNOB, tone & fader cont
	*36B64119B01	KNOB, vol-tuning & sw
	29A541679	LUG, term: power lead
	2S2879	NUT, hex: front radio mtg
	*13D64116B01	OVERLAY, instrument panel
	9A531066	RECEPTACLE, antenna
	34B64034A01	SCALE, dial
	3K560695	SCREW, tpg: # 6 x 1/2 (trans mtg)
	9K544808	SOCKET, dial light
	9B542339	SOCKET, trans
	46B562381	STUD, trimount: cont cover
	4S10059A09	WASHER, spring
	MECHANICAL PARTS - MODEL CO67A	
	7B64317A01	BACKGROUND, dial scale
	84C64072B01	BOARD, plated chassis
	*7B64129B01	BRACKET, dial ret
	30D64088B02	CABLE & PLUG ASSEM: 2-conn (front spkr)
	30D64120B01	CABLE & PLUG ASSEM: 4-conn (front & rear spkr)
	15D64068B01	COVER, top & back
	*13E64123B01	ESCUTCHEON, dial
	14A543810	INSULATOR, transistor
	*36C64118B01	KNOB, tone & rear spkr
	36C64119B01	KNOB, vol-tuning & sw
	29A541679	LUG, term: power lead
	2S2879	NUT, hex: front radio mtg
	*13C64124B01	OVERLAY, instrument panel
	9A531066	RECEPTACLE, antenna
	*34B64130B01	SCALE, dial
	3K560695	SCREW, tpg: #6 x 1/2 (trans mtg)
	9K544808	SOCKET, dial light
	9B542339	SOCKET, trans
	46B562381	STUD, trimount: cont cover
	4S10059A09	WASHER, spring
	MECHANICAL PARTS - MODEL CR67A	
	7B64317A01	BACKGROUND, dial scale
	84C64072B01	BOARD, plated chassis
	7B64316A01	BRACKET, dial ret
	30D64088B02	CABLE & PLUG ASSEM: 2-conn (front spkr)
	*30D64088B01	CABLE & PLUG ASSEM: 2-conn (radio to spkr)
	42K544815	CLIP, dial ret
	15D64068B01	COVER, top & back
	13D64315A01	ESCUTCHEON, dial
	14A543810	INSULATOR, transistor
	36B64313A01	KNOB, tone & rear spkr
	36C64119B01	KNOB, vol-tuning & sw
	29A541679	LUG, term: power lead
	2S119613	NUT, hex: 7/16-28 x 5/8 x 1/8 (front radio mtg)
	9A531066	RECEPTACLE, antenna
	34B64307A01	SCALE, dial
	3K560695	SCREW, tpg: #6 x 1/2 (trans mtg)
	9K544808	SOCKET, dial light
	9B542339	SOCKET, trans
	46B562381	STUD, trimount: cont cover
	MECHANICAL PARTS - MODEL CT67A	
	*64C64073B01	BACKGROUND, dial scale
	84C64072B01	BOARD, plated chassis
	*7B64106B01	BRACKET, dial ret
	30D64088B02	CABLE & PLUG ASSEM: 2-conn (front spkr)
	30D64120B01	CABLE & PLUG ASSEM: 4-conn (front & rear spkr)
	15D64068B01	COVER, top & back
	*13D64082B01	ESCUTCHEON, dial
	14A543810	INSULATOR, transistor
	*36C64085B01	KNOB, tone & rear spkr
	*36C64084B01	KNOB, vol-tuning & sw
	29A541679	LUG, term: power lead
	2S2879	NUT, hex: front radio mtg
	9A531066	RECEPTACLE, antenna
	*34B64083B01	SCALE, dial
	3K560695	SCREW, tpg: #6 x 1/2 (trans mtg)
	9K544808	SOCKET, dial light
	9B542339	SOCKET, trans
	46B562381	STUD, trimount: cont cover
	4S10059A09	WASHER, spring
	MECHANICAL PARTS - MODEL CY67A	
	7B64065A01	BACKGROUND, dial scale
	84C64072B01	BOARD, plated chassis
	7B64064A01	BRACKET, dial ret
	7B64063A01	BRACKET, rcvr mtg (left)
	7A64066A01	BRACKET, rcvr mtg (right)
	30D64088B02	CABLE & PLUG ASSEM: 2-conn (front spkr)
	30D64088B01	CABLE & PLUG ASSEM: 2-conn (radio to spkr)
	15D64068B01	COVER, top & back
	13D64069A01	ESCUTCHEON, dial
	13D64068A01	ESCUTCHEON, overlay
	14A543810	INSULATOR, transistor
	36B543332	KNOB, dummy
	36B543330	KNOB, tone
	*36C64119B01	KNOB, vol-tuning & sw
	29A541679	LUG, term: power lead
	2S119613	NUT, hex: (7/16-28 x 5/8 x 1/8)
	9A531066	RECEPTACLE, antenna
	34B64056A01	SCALE, dial
	3K560695	SCREW, tpg: #6 x 1/2 (trans mtg)
	9K544808	SOCKET, dial light
	9B542339	SOCKET, trans
	46B562381	STUD, trimount: cont cover
	MECHANICAL PARTS - MODEL PT67A	
	64C64073B01	BACKGROUND, dial scale
	84C64072B01	BOARD, plated chassis
	*7B64114B01	BRACKET, dial ret
	30D64088B02	CABLE & PLUG ASSEM: 2-conn (front spkr)
	30D64120B01	CABLE & PLUG ASSEM: 4-conn (front & rear spkr)
	15D64068B01	COVER, top & back
	*13D64112B01	ESCUTCHEON, dial
	14A543810	INSULATOR, transistor
	36B64049A01	KNOB, tone & rear spkr
	36B64174B01	KNOB, vol-tuning & sw
	29A541679	LUG, term: power lead
	2S119613	NUT, hex: 7/16"-28 x 5/8 x 1/8
	9A531066	RECEPTACLE, antenna
	*34B64127B01	SCALE, dial
	3K560695	SCREW, tpg: #6 x 1/2 (trans mtg)
	9K544808	SOCKET, dial light
	9B542339	SOCKET, trans
	46B562381	STUD, trimount: cont cover
	4S10059A09	WASHER, spring
	MECHANICAL PARTS - MODEL TM7A	
	7B64664A03	BACKGROUND, dial scale
	*84C64072B01	BOARD, plated chassis
	*15D64068B01	COVER, top
	13C64661A01	ESCUTCHEON, dial
	14A543810	INSULATOR, transistor
	36K543399	KNOB, pendant
	36B543398	KNOB, tone
	36B543382	KNOB, vol-tuning-sw
	29S10134A02	LUG, spkr term
	29K534326	LUG, term: fuse recept
	13K544854	MASK, dial
	2S119601	NUT, hex: 3/8-32 x 9/16 (vol cont mtg)

Ref. No.	Part Number	Description
	*2S10101A29	NUT, push-on: dial and mask ret
	9A531066	RECEPTACLE, ant
	9K543179	RECEPTACLE, fuse (USE 9K534968)
	*34B64142B01	SCALE, dial
	3K560695	SCREW, tpg: #6 x 1/2 (trans mtg)
	9K544808	SOCKET, dial light (USE 9K544543)
	9B542339	SOCKET, trans
	46B562381	STUD, trimount: cont cover
	4A64362A01	WASHER, locating: vol control spacer
		INSTALLATION PARTS - MODEL CE67A
	*1V64966A29	RADIO INSTALLATION KIT
	*7B64104B01	BRACKET, radio
	*7C64082A02	BRACKET, spkr mtg
	30K542673	CABLE, grounding: 4-1/4"
	30K544844	CABLE, grounding: 10-1/2"
	8K544722	CAPACITOR, ignition coil
	8A4491	CAPACITOR, noise suppr
	65S61688	FUSE, 4 amp: 3AG
	2S10054A02	NUT, clip-on: #14 (spkr & brkt mtg)
	3S132240	SCREW, tpg: #14 x 1/2
	3S127873	SCREW, tpg: #1/4 x 1/2 pln hex C
	*3S125947	SCREW, tpg: #14 x 3/4
		INSTALLATION PARTS - MODEL CO67A
	*1V64966A80	RADIO INSTALLATION KIT
	*7B64128B01	BRACKET, radio
	*7C64126B01	BRACKET, spkr mtg
	43B64598A01	BUSHING, SPACER: radio mtg
	30K544828	CABLE, grounding: 5" (USE 30K544768)
	30K544824	CABLE, grounding: 12"
	8K544722	CAPACITOR, ignition coil
	65S61688	FUSE, 4 amp: 3AG
	2S10054A02	NUT, clip-on: #14 (spkr & brkt mtg)
	3S124683	SCREW, tpg: #1/4 x 1/2 (grnd cable & radio mtg)
	3S127873	SCREW, tpg: #1/4 x 1/2 pln hex C
	*3S125947	SCREW, tpg: #14 x 3/4
		INSTALLATION PARTS - MODEL CR67A
	*1V64966A63	RADIO INSTALLATION KIT
	*7A64102B01	BRACKET, radio
	7C64314A01	BRACKET, spkr mtg
	8B544383	CAPACITOR, ignition coil
	8K544722	CAPACITOR, noise suppr
	65S61688	FUSE, 4 amp: 3AG
	2S10054A02	NUT, clip-on: #14 (spkr & brkt mtg)
	3S132532	SCREW, tpg: #14 x 5/8
	3S135103	SCREW, tpg: #14 x 1-1/4
		INSTALLATION PARTS - MODEL CT67A
	*1V64966A35	RADIO INSTALLATION KIT
	*7B64122B01	BRACKET, radio
	*7C64108B01	BRACKET, spkr mtg
	43B64598A01	BUSHING, SPACER: radio mtg
	30K542673	CABLE, grounding: 4-1/4" (USE 30B538347)
	30K542674	CABLE, grounding: 9-1/2"
	30K544824	CABLE, grounding: 12"
	8K544722	CAPACITOR, ignition coil
	65S61688	FUSE, 4 amp: 3AG
	2S10054A13	NUT, clip-on: #10 type U
	2S10054A02	NUT, clip-on: #14 (spkr & brkt mtg)
	3S124683	SCREW, tpg: 1/4 x 1/2 (grnd cable & radio mtg)
	*3S127873	SCREW, tpg: #1/4" x 1/2 pln hex C
	3S129278	SCREW, tpg: #14 x 1 pln hex A
		INSTALLATION PARTS - MODEL CY67A
	*1V64966A67	RADIO INSTALLATION KIT
	*7A64103B01	BRACKET, radio
	*7C64082A02	BRACKET, spkr mtg
	30K544885	CABLE, grounding: 6" (USE 30B544831)
	30K542876	CABLE, grounding: 8-1/2" (USE 30K542674)
	8K544722	CAPACITOR, ignition coil
	65S61688	FUSE, 4 amp: 3AG
	2S10054A02	NUT, clip-on: #14 (spkr & brkt mtg)
	2S119613	NUT, hex: 7/16-28-5/8 x 1/8
	3S129974	SCREW, cap: 3/8-16 x 7/16 pln hex
	3S127873	SCREW, tpg: #1/4" x 1/2 pln hex C
	3S132240	SCREW, tpg: #14 x 1/2
	3S125947	SCREW, tpg: #14 x 3/4 pln hex A
		INSTALLATION PARTS - MODEL PT67A
	*1V64966A73	RADIO INSTALLATION KIT
	*7B64110B01	BRACKET, radio
	*7B64111B01	BRACKET, spkr mtg
	30K542673	CABLE, grounding: 4-1/4"
	30K544768	CABLE, grounding: 6"
	8K544722	CAPACITOR, ignition coil
	65S61688	FUSE, 4 amp
	*3S124825	SCREW, tpg: #10 x 3/8
	*3S125637	SCREW, tpg: #10 x 5/8
	*3S7482	SCREW, tpg: #10 x 3/4 (spkr brkt)
	3S132532	SCREW, tpg: #14 x 5/8
		INSTALLATION PARTS - MODEL TM7A
	1V64952A11	RADIO INSTALLATION KIT
	45K538873	ARM, adaptor: fuse recept
	8A4491	CAPACITOR, noise suppr
	2S121771	NUT, hex: 3/8-32 x 9/16 (front radio mtg)
	2S2878	NUT, hex: 1/4-20 x 7/16 (strap mtg)
	2A64784A01	NUT, shoulder: radio spacer
	3S9694	SCREW, mach: 1/4-20 x 1-1/2 (strap mtg)
	3S132240	SCREW, tpg: #14 x 1/2 (strap mtg)
	42K544845	STRAP, radio mtg
		TUNER PARTS - MODEL CE67A
	*1U43500A22	TUNER, AT-623: complete
	43K471633	BEARING, ball
	1A562758	CLUTCH & DISC ASSEM: incls set screw
	1V41001B77	COILS & MTG PLATE ASSEM: incl L-2, L-4 & L-5
	76K563286	CORE, tuning: ant & RF
	76K563288	CORE, tuning: osc
	1C41794A02	CROWN GEAR & PINION ASSEM
	1K565223	GEAR, BUSHING & DISC ASSEM
	5B562438	GROMMET, core mtg
	52C42062A31	POINTER, dial
	38C40283B02	PUSHBUTTON, first, third & fifth
	38C40283B01	PUSHBUTTON, second & fourth
	49A562480	ROLLER, clutch release
	1V562830	SCREW & NUT ASSEM: adjust
	3A563128	SCREW, set: clutch assem
	47C40452A76	SHAFT, tuning
	41A562449	SPRING, anti-rattle
	41A562447	SPRING, clutch release
	41B562503	SPRING, pointer tension
	41K560445	SPRING, retaining: tuning shaft
	4K692188	WASHER, "C": pointer
	4A562431	WASHER, cup
		TUNER PARTS - MODEL CO67A
	*1U43500A23	TUNER, AT-624: complete
	43K471633	BEARING, ball
	1A562758	CLUTCH & DISC ASSEM: incls set screw
	1V41001B77	COILS & MTG PLATE ASSEM: incl L-2, L-4 & L-5
	76K563286	CORE, tuning: ant & RF
	76K563288	CORE, tuning: osc
	1C41794A02	CROWN GEAR & PINION ASSEM
	1K565223	GEAR, BUSHING & DISC ASSEM
	5B562438	GROMMET, core mtg
	*52C40244B07	POINTER, dial
	38C41068B02	PUSHBUTTON, first, third & fifth
	38C41068B01	PUSHBUTTON, second & fourth

Ref. No.	Part Number	Description
	49A562480	ROLLER, clutch release
	1V562830	SCREW & NUT ASSEM: adjust
	3A563128	SCREW, set: clutch assem
	*47C40452A91	SHAFT, tuning
	41A562449	SPRING, anti-rattle
	41A562447	SPRING, clutch release
	41B562503	SPRING, pointer tension
	41K560445	SPRING, retaining: tuning shaft
	4K692188	WASHER, "C": pointer
	4A562431	WASHER, cup

TUNER PARTS - MODEL CR67A

Ref. No.	Part Number	Description
	*1U43500A24	TUNER, AT-625: complete
	43K471633	BEARING, ball
	1A562758	CLUTCH & DISC ASSEM: incls set screw
	1V41001B77	COILS & MTG PLATE ASSEM: incl L-2, L-4 & L-5
	76K563286	CORE, tuning: ant & RF
	76K563288	CORE, tuning: osc
	1C41794A02	CROWN GEAR & PINION ASSEM
	1K565223	GEAR, BUSHING & DISC ASSEM
	5B562438	GROMMENT, core mtg
	52C40244B07	POINTER, dial
	38C40283B02	PUSHBUTTON, first, third & fifth
	38C40283B01	PUSHBUTTON, second & fourth
	49A562480	ROLLER, clutch release
	1V562830	SCREW & NUT ASSEM: adjust
	3A563128	SCREW, set: clutch assem
	*1B43449A02	SHAFT, tuning
	41A562449	SPRING, anti-rattle
	41A562447	SPRING, clutch release
	41B562503	SPRING, pointer tension
	41K560445	SPRING, retaining: tuning shaft
	4K692188	WASHER, "C": pointer
	4A562431	WASHER, cup

TUNER PARTS - MODEL CT67A

Ref. No.	Part Number	Description
	*1U43500A19	TUNER, AT-626: complete
	43K471633	BEARING, ball
	1A562758	CLUTCH & DISC ASSEM: incls set screw
	1V41001B77	COILS & MTG PLATE ASSEM: incl L-2, L-4 & L-5
	76K563286	CORE, tuning: ant & RF
	76K563288	CORE, tuning: osc
	1C41794A02	CROWN, GEAR & PINION ASSEM
	1K565223	GEAR, BUSHING & DISC ASSEM
	5B562438	GROMMET, core mtg
	*52C40244B08	POINTER, dial
	*38C41068B02	PUSHBUTTON: first, third & fifth
	*38C41068B01	PUSHBUTTON: second & fourth
	49A562480	ROLLER, clutch release
	1V562830	SCREW & NUT ASSEM: adjust
	3A563128	SCREW, set: clutch assem
	*47C40452A94	SHAFT, tuning
	41A562449	SPRING, anti-rattle
	41A562447	SPRING, clutch release
	41B562503	SPRING, pointer tension
	41K560445	SPRING, retaining: tuning shaft
	4K692188	WASHER, "C": pointer
	4A562431	WASHER, cup

TUNER PARTS - MODEL CY67A

Ref. No.	Part Number	Description
	*1U43500A20	TUNER, AT-627: complete
	43K471633	BEARING, ball
	1A562758	CLUTCH & DISC ASSEM: incl set screw
	1V41001B77	COILS & MTG PLATE ASSEM: incl L-2, L-4 & L-5
	76K563286	CORE, tuning: ant & RF
	76K563288	CORE, tuning: osc
	1C41794A02	CROWN GEAR & PINION ASSEM
	1K565223	GEAR, BUSHING & DISC ASSEM
	5B562438	GROMMET, core mtg
	52C40244B01	POINTER, dial
	38C44097A08	PUSHBUTTON, first, third & fifth
	38C44097A07	PUSHBUTTON, second & fourth
	49A562480	ROLLER, clutch release
	1V562830	SCREW & NUT ASSEM: adjust
	3A563128	SCREW, set: clutch assem
	47C40452A79	SHAFT, tuning
	41A562449	SPRING, anti-rattle
	41A562447	SPRING, clutch release
	41B562503	SPRING, pointer tension
	41K560445	SPRING, retaining: tuning shaft
	4K692188	WASHER, "C": pointer
	4A562431	WASHER, cup

TUNER PARTS - MODEL PT67A

Ref. No.	Part Number	Description
	*1U43500A21	TUNER, AT-628: complete
	43K471633	BEARING, ball
	1A562758	CLUTCH & DISC ASSEM: incls set screw
	1V41001B77	COILS & MTG PLATE ASSEM: incl L-2, L-4 & L-5
	76K563286	CORE, tuning: ant & RF
	76K563288	CORE, tuning: osc
	1C41794A02	CROWN GEAR & PINION ASSEM
	1K565223	GEAR, BUSHING & DISC ASSEM
	5B562438	GROMMET, core mtg
	*52C40244B09	POINTER, dial
	38C44097A08	PUSHBUTTON, first, third & fifth
	38C44097A07	PUSHBUTTON, second & fourth
	49A562480	ROLLER, clutch release
	1V562830	SCREW & NUT ASSEM: adjust
	3A563128	SCREW, set: clutch assem
	*47C40452A97	SHAFT, tuning
	41A562449	SPRING, anti-rattle
	41A562447	SPRING, clutch release
	41B562503	SPRING, pointer tension
	41K560445	SPRING, retaining: tuning shaft
	4K692188	WASHER, "C": pointer
	4A562431	WASHER, cup

TUNER PARTS - MODEL TM7A

Ref. No.	Part Number	Description
	*77D42935A07	TUNER, AT-618: complete
	43K471633	BEARING, ball
	45A40838A01	BRACKET, link
	43B41624A01	BUSHING, tuning shaft
	1A562758	CLUTCH & DISC ASSEM: incls set screw
	*1V41001B77	COILS & MTG PLATE ASSEM: incl L-2, L-4 & L-5
	76K563286	CORE, tuning: antenna and RF
	76K563288	CORE, tuning: osc
	1C41794A10	CROWN GEAR & PINION ASSEM
	1B40846A01	DRIVE DISC & SPACER ASSEM
	1B562642	GEAR, BUSHING & DISC ASSEM
	5B562438	GROMMET, core mtg
	2K560468	NUT, hex: 3/8-32 (bushing mtg)
	1B40847A02	PINION SHAFT & DISC ASSEM
	1B40875A01	POINTER, dial
	38B563819	PUSHBUTTON
	49A562480	ROLLER, clutch release (USE 46R564897)
	1V562830	SCREW & NUT ASSEM: adjust
	3A563128	SCREW, set: clutch assem
	1A40844A03	SHAFT, tuning: incls disc
	41A562449	SPRING, anti-rattle
	41A562447	SPRING, clutch release
	41B562503	SPRING, pointer tension
	41K560445	SPRING, retaining: tuning shaft
	4K692188	WASHER, "C": pointer
	4K601456	WASHER, "C": tuning shaft
	4A562431	WASHER, cup
	4A41625A01	WASHER, shaft bearing: tuning shaft
	4C40104A04	WASHER, spring: drive disc & spacer ret
	4A42901A01	WASHER, stop: bushing

REAR SPEAKER PARTS - MODEL KM15S

Ref. No.	Part Number	Description
	13C543043	GRILLE, speaker
E-7	50D64024A01	SPEAKER, 6 x 9 PM: 8Ω VC

INSTALLATION PARTS - MODEL KM15S

Ref. No.	Part Number	Description
	3A543097	BOLT, key
	30V544905	CABLE & PLUG ASSEM: 4-conn
	*1V64950A36	INSTALLATION KIT
	29S10134A02	LUG, term: blk & grn leads
	2S7003	NUT, hex: 8-32 x 5/16
	3S128262	SCREW, mach: 8-32 x 1

REAR SPEAKER PARTS - MODEL KM19S

Ref. No.	Part Number	Description
E-7	50C64053A01	SPEAKER, 6 PM: 8Ω VC
	30D64168B01	CABLE & PLUG ASSEM: inter-connecting

*DENOTES NEW ITEM APPEARING IN ANY LIST FOR FIRST TIME.

MOTOROLA COLOR TV CHASSIS TS-91

THIS SERVICE INFORMATION IS FOR THE USE OF QUA

INSTALLATION AND SERVICE

AUTOMATIC DEGAUSSER

This receiver is equipped with an automatic built-in degausser. It is a temperature controlled unit and is activated each time the receiver is turned on. The degaussing action takes place within the first second after the receiver is turned on and before the picture comes on. The degaussing action cannot be seen. To degauss after the receiver has been on and has reached its maximum operating temperature, it will be necessary to turn the receiver off and allow it to cool for approximately 5 minutes. If the receiver has been on for only a few minutes, then the required cooling period is reduced.

Upon initial installation, we suggest you degauss the entire receiver and picture tube with a conventional portable degaussing coil.

FOCUSING ADJUSTMENT

Set brightness and contrast for normal picture. Then adjust focus control for best overall focus, center to edge of screen.

DEFLECTION YOKE TILT ADJUSTMENT

Loosen the yoke retainer clamp and rotate yoke until picture is straight. Do not slide yoke forward or backwards on the neck of the tube as purity will be affected. Tighten the clamp screws when adjustment is completed.

PICTURE CENTERING

Vertical and horizontal centering controls are located on the chassis.

NOTE: Large control excursions may affect convergence.

VERTICAL SIZE & LINEARITY (Control located on Convergence Panel "H")

Slight adjustments can be made with the vertical size control without affecting vertical linearity. Large control excursions should only be made prior to convergence.

HORIZONTAL SIZE & HIGH VOLTAGE ADJUSTMENT (Control located on Pincushion Panel "G")

1. Reduce brightness control to minimum. Raster must be extinguished.

2. Meter 2nd anode voltage (2nd anode to chassis ground.)

3. At normal line voltage (122V AC), adjust control for 27Kv.

Alternate Method 1

1. Use a variable AC source (variac) and adjust input to receiver to 102V AC.

2. Adjust horizontal size (high voltage) control so that the picture just makes horizontal size.

NOTE: At normal line voltage (122V AC)

5. Set BRIGHTNESS and CONTRAS trols to maximum.

6. Set HORIZONTAL SIZE control t mum (fully CCW). Then, slowly advan trol until the vertical lines on both s the raster are straight.

NOTE: At normal line voltage (12 and minimum brightness (raster guished), the 2nd anode voltage sho exceed 27Kv.

HORIZONTAL HOLD ADJUSTMEN (Control located on Horiz. Panel

Adjust the horizontal hold for most horizontal sync while switching from c to channel.

FINE TUNING ADJUSTMENT

This receiver employs a VHF tuner concentric pre-set fine tuning mechan

Rotating the fine tuning knob in eithe tion automatically engages the fine mechanism and automatically dise when knob is released.

To fine tune, rotate fine tuning k either direction for best picture and Also see AFC ADJUSTMENT.

AFC OPERATION

The AFC is activated by the 45.75Mc in the video IF. The 45.75Mc car amplified and fed to a discriminator former tuned to the center freque 45.75Mc. Two (2) diodes in the sec of the discriminator rectify this sign provide a DC voltage relative to a quency changes produced by the va of the 45.75Mc carrier. This DC cha fed to a varactor across the local os in the tuner. The resultant DC cor voltage shifts the oscillator frequen necessary to maintain the video (45.75Mc) at its proper fine tuned p with respect to the video IF response.

AFC ADJUSTMENT PROCEDURE (Control Locations On AFC Panel)

Check operation of AFC as follows:

Defeat AFC by pulling out on the VH tune knob.

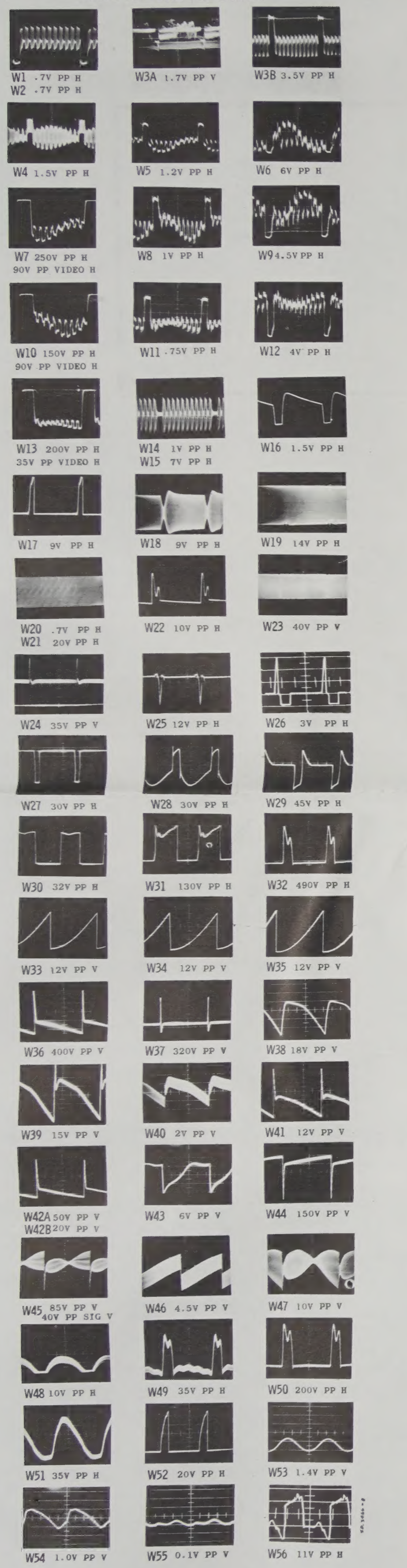
Fine tune to a station for best color p (just off burble). Push in fine tune kn activate AFC circuit, the picture shou main the same without severe detunin

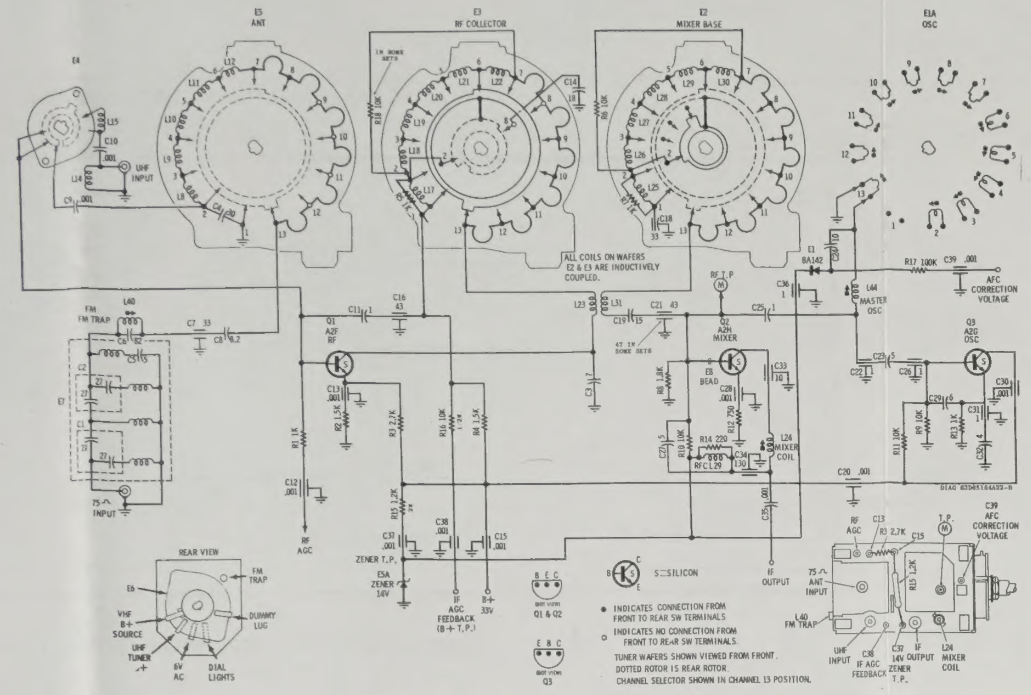
If loss of color or detuning is presen following adjustments are recommend

1. Pull out the AFC knob and adjus tuning for best color picture.

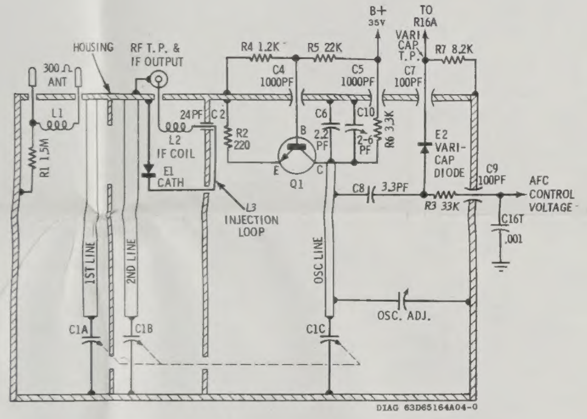
2. Adjust VTVM for zero center scale.
   TS-919: Connect VTVM to center ductor of the shielded cable attach rear of UHF tuner (AFC lead).

CIRCUIT WAVEFORMS

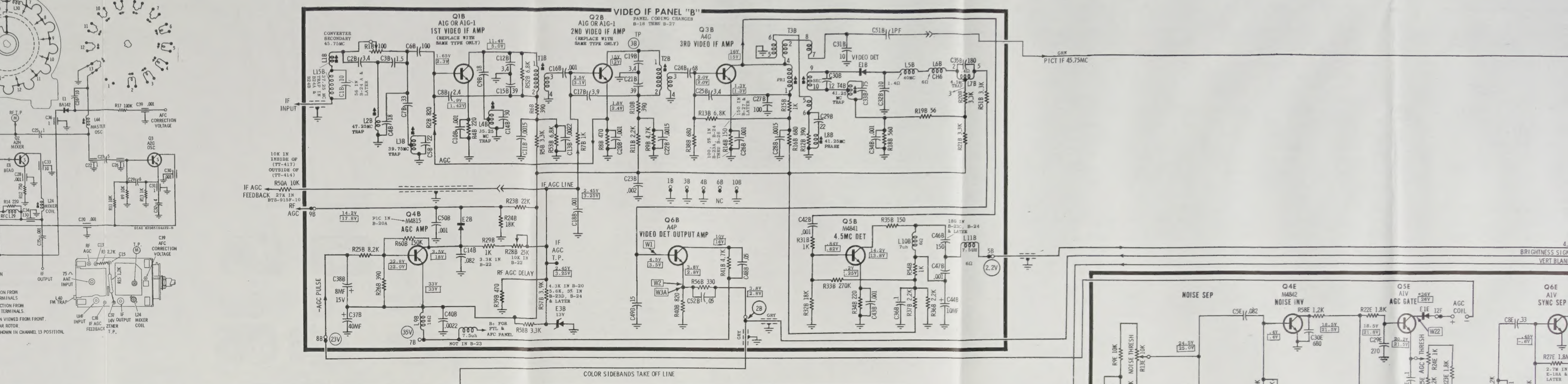


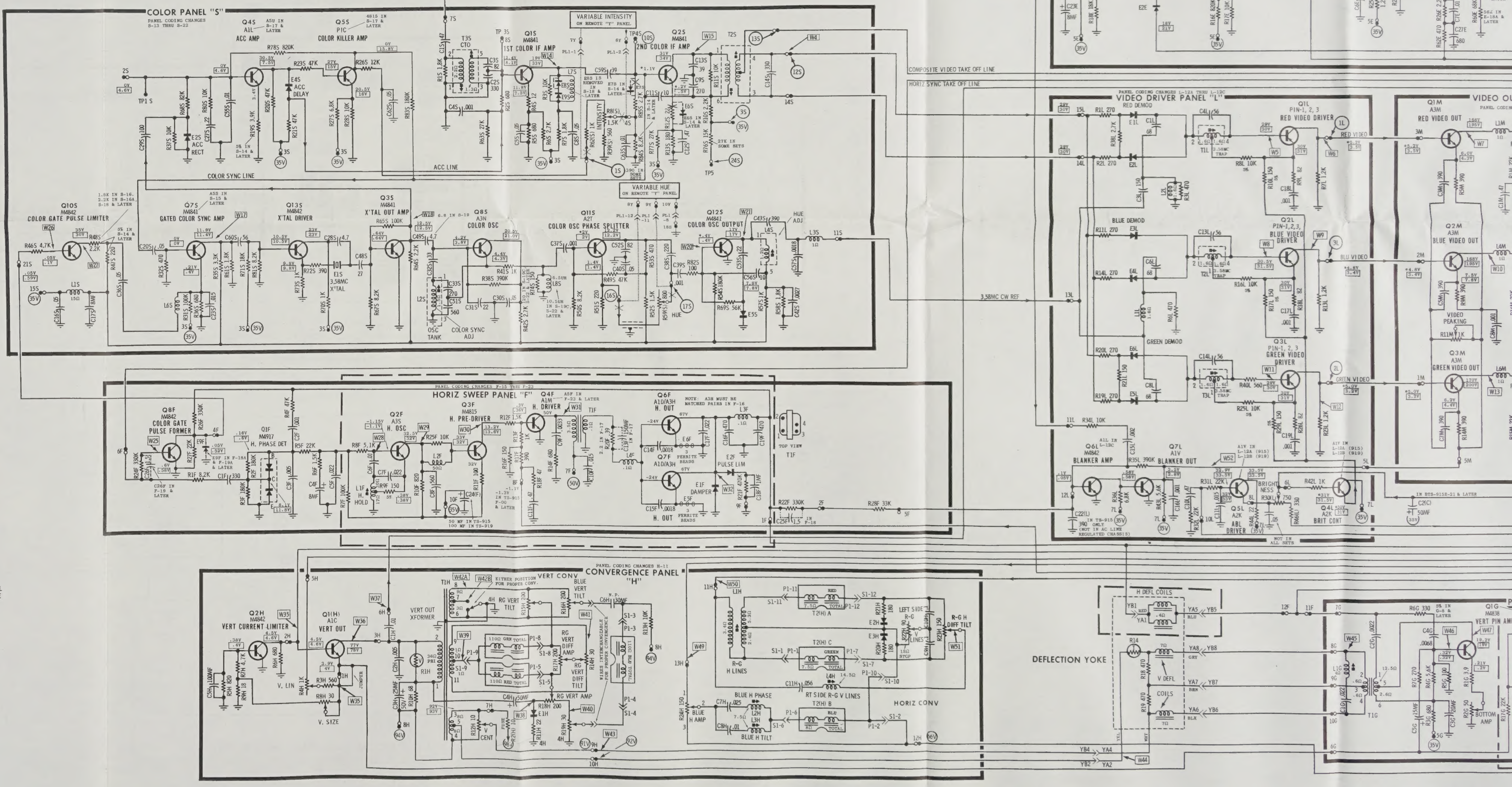

ALL COILS ON WAFERS E2 & E3 ARE INDUCTIVELY COUPLED.
AFC CORRECTION VOLTAGE
REAR VIEW
INDICATES CONNECTION FROM FRONT TO REAR SW TERMINALS.
INDICATES NO CONNECTION FROM FRONT TO REAR SW TERMINALS.
TUNER WAFERS SHOWN VIEWED FROM FRONT. DOTTED ROTOR IS REAR ROTOR. CHANNEL SELECTOR SHOWN IN CHANNEL 13 POSITION.

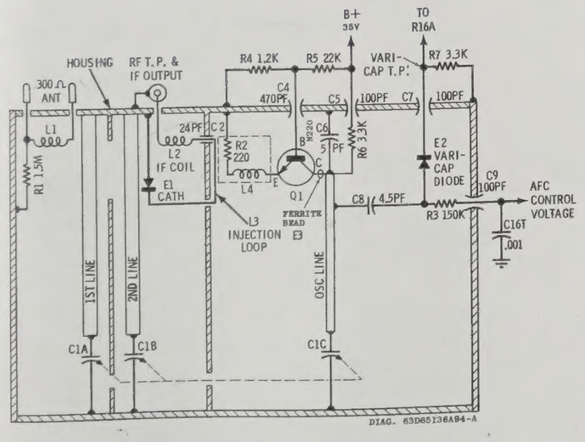
VHF TUNER TT-417


HOUSING
RF T.P. & IF OUTPUT
300 Ω ANT
INJECTION LOOP
OSC LINE
OSC. ADJ.
VARI-CAP DIODE
AFC CONTROL VOLTAGE
1ST LINE
2ND LINE

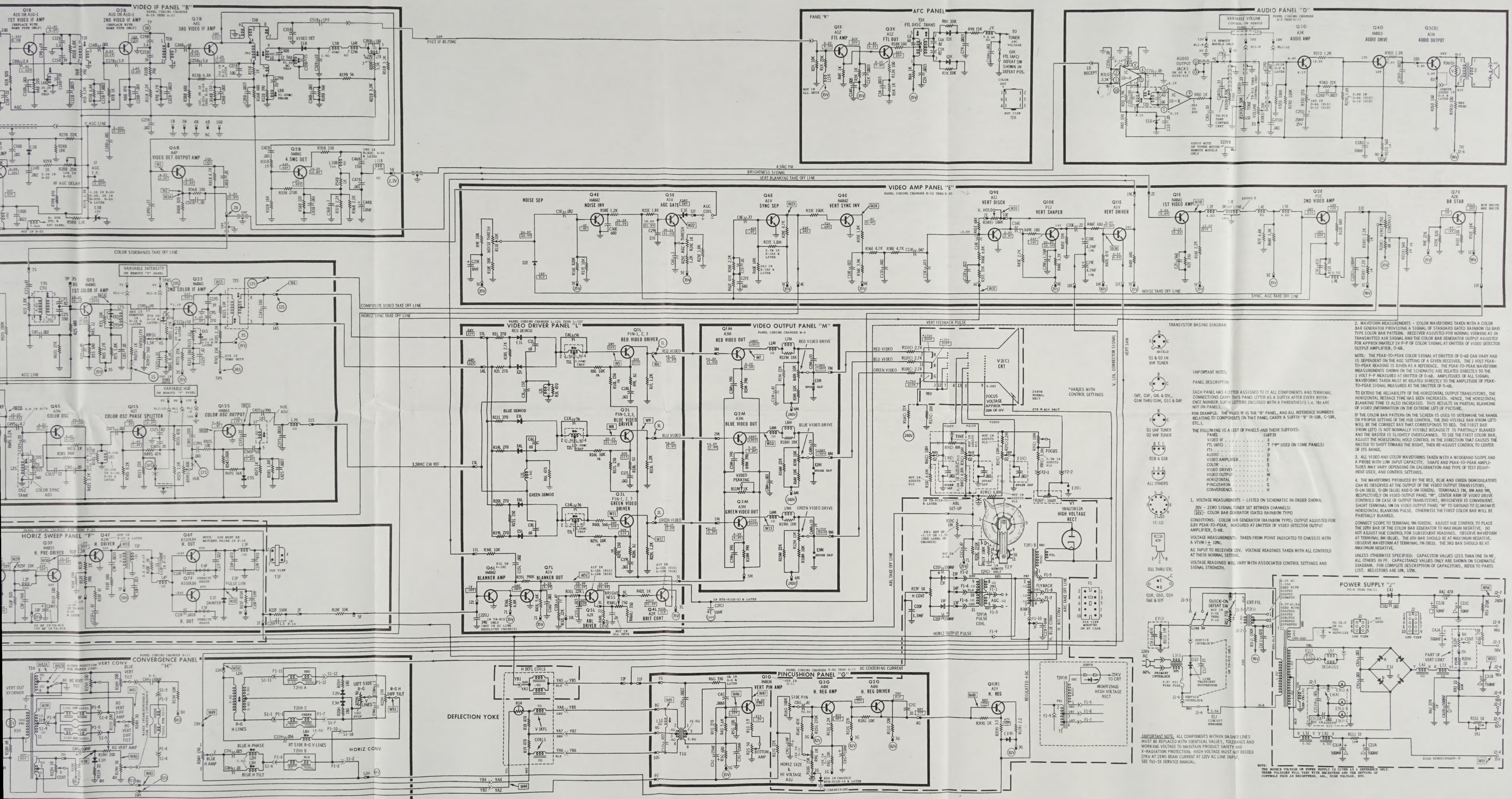
UHF TUNER TT-631 & TT-633


VIDEO IF PANEL "B"
1ST VIDEO IF AMP
2ND VIDEO IF AMP
3RD VIDEO IF AMP
AGC AMP
VIDEO DET OUTPUT AMP
4.5MC DET
IF AGC FEEDBACK
RF AGC
NOISE SEP
NOISE INV
AGC GATE
SYNC SEP
BRIGHTNESS


COLOR PANEL "S"
ACC AMP
COLOR KILLER AMP
1ST COLOR IF AMP
2ND COLOR IF AMP
VARIABLE INTENSITY
COLOR GATE PULSE LIMITER
GATED COLOR SYNC AMP
X'TAL DRIVER
X'TAL OUT AMP
COLOR OSC
COLOR OSC PHASE SPLITTER
COLOR OSC OUTPUT
VARIABLE HUE
HUE ADJ
COLOR SYNC LINE
ACC LINE
COMPOSITE VIDEO TAKE OFF LINE
HORIZ SYNC TAKE OFF LINE
HORIZ SWEEP PANEL "F"
COLOR GATE PULSE FORMER
H. PHASE DET
H. PRE DRIVER
H. OSC
H. DRIVER
H. OUT
DAMPER
VIDEO DRIVER PANEL "L"
RED DEMOD
BLUE DEMOD
GREEN DEMOD
RED VIDEO DRIVER
BLUE VIDEO DRIVER
GREEN VIDEO DRIVER
BLANKER AMP
BLANKER OUT
VIDEO OUT
RED VIDEO OUT
BLUE VIDEO OUT
GREEN VIDEO OUT
CONVERGENCE PANEL "H"
VERT CURRENT LIMITER
VERT OUT
V. LIN
V. SIZE
VERT CONV
RG VERT TILT
RG VERT DIFF AMP
RG VERT AMP
BLUE VERT TILT
HORIZ CONV
BLUE H PHASE
BLUE H TILT
R-G H LINES
RT SIDE R-G V LINES
LEFT SIDE R-G H
DEFLECTION YOKE
H DEFL COILS
V DEFL COILS
3.58MC CW REF


HOUSING
RF T.P. & IF OUTPUT
300 Ω ANT
INJECTION LOOP
FERRITE BEAD
OSC LINE
VARI-CAP DIODE
AFC CONTROL VOLTAGE
1ST LINE
2ND LINE

UHF TUNER TT-630 & TT-632


VIDEO IF PANEL "B"
AFC PANEL
AUDIO PANEL "D"
VIDEO AMP PANEL "E"
VIDEO DRIVER PANEL "L"
VIDEO OUTPUT PANEL "M"
HORIZ SWEEP PANEL "F"
CONVERGENCE PANEL "H"
PINCUSHION PANEL "G"
POWER SUPPLY "J"
PS-8 THRU PS-11
DEFLECTION YOKE
V2(C) CRT
V1 3BN2/3BS2A HIGH VOLTAGE RECT
COLOR SIDEBANDS TAKE OFF LINE
COMPOSITE VIDEO TAKE OFF LINE
HORIZ SYNC TAKE OFF LINE
VERT FEEDBACK PULSE
BRIGHTNESS SIGNAL
VERT BLANKING TAKE OFF LINE
4.5MC FM
3.58MC CW REF
NOISE TAKE OFF LINE
SYNC, AGC TAKE OFF LINE
ABL TAKE OFF LINE
ARC TAKE OFF LINE
HORIZ OUTPUT PULSE
DC CENTERING CURRENT
TRANSISTOR BASING DIAGRAM
Q1 & Q3 IN VHF TUNER
Q4T, Q3F, Q4L & Q5L, Q1M THRU Q3M, Q1G & Q4F
Q1 UHF TUNER
Q2 VHF TUNER
Q1B & Q2B
ALL OTHERS
IC-1D
Q1L THRU Q3L
Q1R, Q5D, Q1H Q6E & Q7F
DIAG 63B01956A59-B

IMPORTANT NOTES:

PANEL DESCRIPTION

EACH PANEL HAS A LETTER ASSIGNED TO IT. ALL COMPONENTS AND TERMINAL CONNECTIONS CARRY THIS PANEL LETTER AS A SUFFIX AFTER EVERY REFERENCE NUMBER. SUFFIX LETTERS ENCLOSED WITH A PARENTHESIS i.e. (B) ARE NOT ON PANELS.

FOR EXAMPLE: THE VIDEO IF IS THE "B" PANEL, AND ALL REFERENCE NUMBERS RELATING TO COMPONENTS ON THAT PANEL CARRY A SUFFIX "B" (R-10B, C-10B, ETC.).

THE FOLLOWING IS A LIST OF PANELS AND THEIR SUFFIXES:

PANEL	SUFFIX
VIDEO IF	B
FTL (AFC)	T ("P" USED ON SOME PANELS)
FTI	P
AUDIO	D
VIDEO AMPLIFIER	E
COLOR	S
VIDEO DRIVER	L
VIDEO OUTPUT	M
HORIZONTAL	F
PINCUSHION	G
CONVERGENCE	H

1. VOLTAGE MEASUREMENTS - LISTED ON SCHEMATIC IN ORDER SHOWN.

20V - ZERO SIGNAL (TUNER SET BETWEEN CHANNELS)
$\boxed{16V}$ - COLOR BAR GENERATOR (GATED RAINBOW TYPE)

CONDITIONS: COLOR BAR GENERATOR (RAINBOW TYPE); OUTPUT ADJUSTED FOR 0.8V PEAK-TO-PEAK. MEASURED AT EMITTER OF VIDEO DETECTOR OUTPUT AMPLIFIER, O-6B.

VOLTAGE MEASUREMENTS: TAKEN FROM POINT INDICATED TO CHASSIS WITH A VTVM (± 10%).

AC INPUT TO RECEIVER 120V. VOLTAGE READINGS TAKEN WITH ALL CONTROLS AT THEIR NORMAL SETTING.

VOLTAGE READINGS WILL VARY WITH ASSOCIATED CONTROL SETTINGS AND SIGNAL STRENGTH.

2. WAVEFORM MEASUREMENTS - COLOR WAVEFORMS TAKEN WITH A COLOR BAR GENERATOR PROVIDING A SIGNAL OF STANDARD GATED RAINBOW (10 BAR) TYPE COLOR BAR PATTERN. RECEIVER ADJUSTED FOR NORMAL VIEWING AS IN TRANSMITTED AIR SIGNAL AND THE COLOR BAR GENERATOR OUTPUT ADJUSTED FOR APPROXIMATELY 1V P-P OF COLOR SIGNAL AT EMITTER OF VIDEO DETECTOR OUTPUT AMPLIFIER, O-6B.

NOTE: THE PEAK-TO-PEAK COLOR SIGNAL AT EMITTER OF O-6B CAN VARY AND IS DEPENDENT ON THE AGC SETTING OF A GIVEN RECEIVER. THE 1 VOLT PEAK-TO-PEAK READING IS GIVEN AS A REFERENCE. THE PEAK-TO-PEAK WAVEFORM MEASUREMENTS SHOWN ON THE SCHEMATIC ARE RELATED DIRECTLY TO THE 1 VOLT P-P MEASURED AT EMITTER OF O-6B. AMPLITUDES OF ALL SIGNAL WAVEFORMS TAKEN MUST BE RELATED DIRECTLY TO THE AMPLITUDE OF PEAK-TO-PEAK SIGNAL MEASURED AT THE EMITTER OF O-6B.

TO EXTEND THE RELIABILITY OF THE HORIZONTAL OUTPUT TRANSISTORS, THE HORIZONTAL RETRACE TIME HAS BEEN INCREASED. HENCE, THE HORIZONTAL BLANKING TIME IS ALSO INCREASED. THIS RESULTS IN PARTIAL BLANKING OF VIDEO INFORMATION ON THE EXTREME LEFT OF PICTURE.

IF THE COLOR BAR PATTERN ON THE SCREEN IS USED TO DETERMINE THE RANGE OR PROPER SETTING OF THE HUE CONTROL, THE 2ND VISIBLE BAR (FROM LEFT) WILL BE THE CORRECT BAR THAT CORRESPONDS TO RED. THE FIRST BAR (FROM LEFT) IS NOT NORMALLY VISIBLE BECAUSE IT IS PARTIALLY BLANKED AND THE RASTER IS SLIGHTLY OVERSCANNED. TO SEE THE FIRST COLOR BAR, ADJUST THE HORIZONTAL HOLD CONTROL IN THE DIRECTION THAT CAUSES THE RASTER TO SHIFT TOWARD THE RIGHT, THEN RE-ADJUST CONTROL TO CENTER OF ITS RANGE.

3. ALL VIDEO AND COLOR WAVEFORMS TAKEN WITH A WIDEBAND SCOPE AND A PROBE WITH LOW INPUT CAPACITY. SHAPE AND PEAK-TO-PEAK AMPLITUDES MAY VARY DEPENDING ON CALIBRATION AND TYPE OF TEST EQUIPMENT USED, AND CONTROL SETTINGS.

4. THE WAVEFORMS PRODUCED BY THE RED, BLUE AND GREEN DEMODULATORS CAN BE OBSERVED AT THE OUTPUT OF THE VIDEO OUTPUT TRANSISTORS, Q-1M (RED), Q-2M (BLUE) AND Q-3M (GREEN). TERMINALS 7M, 8M AND 9M, RESPECTIVELY ON VIDEO OUTPUT PANEL "M", CENTER ARM OF VIDEO DRIVE CONTROLS OR CASE OF OUTPUT TRANSISTORS, WHICHEVER IS CONVENIENT. SHORT TERMINAL 5M ON VIDEO OUTPUT PANEL "M" TO GROUND TO ELIMINATE HORIZONTAL BLANKING PULSE. OTHERWISE THE FIRST COLOR BAR WILL BE PARTIALLY BLANKED.

CONNECT SCOPE TO TERMINAL 9M (GREEN). ADJUST HUE CONTROL TO PLACE THE 10TH BAR OF THE COLOR BAR GENERATOR TO MAXIMUM NEGATIVE. DO NOT ADJUST HUE CONTROL FOR SUBSEQUENT READINGS. OBSERVE WAVEFORM AT TERMINAL 8M (BLUE). THE 6TH BAR SHOULD BE AT MAXIMUM NEGATIVE. OBSERVE WAVEFORM AT TERMINAL 7M (RED). THE 3RD BAR SHOULD BE AT MAXIMUM NEGATIVE.

UNLESS OTHERWISE SPECIFIED: CAPACITOR VALUES LESS THAN ONE IN MF, ALL OTHERS IN PF. CAPACITANCE VALUES ONLY ARE SHOWN ON SCHEMATIC DIAGRAM. FOR COMPLETE DESCRIPTION OF CAPACITORS, REFER TO PARTS LIST. RESISTORS ARE 10%, 1/2W.

IMPORTANT NOTE: ALL COMPONENTS WITHIN DASHED LINES MUST BE REPLACED WITH IDENTICAL VALUES, TOLERANCE AND WORKING VOLTAGE TO MAINTAIN PRODUCT SAFETY AND X-RADIATION PROTECTION: HIGH VOLTAGE MUST NOT EXCEED 27KV AT ZERO BEAM CURRENT AT 122V AC LINE INPUT. SEE TV1-S5 SERVICE MANUAL.

NOTE:
THE SOURCE VOLTAGE ON POWER SUPPLY IS GIVEN AS A REFERENCE ONLY. THESE VOLTAGES WILL VARY WITH RECEIVERS AND THE SETTING OF CONTROLS SUCH AS BRIGHTNESS, ABL, HIGH VOLTAGE, ETC.

MOTOROLA COLOR TV CHASSIS C25, AD25, & G23TS-915

5 & 919 SERIES

IFIED SERVICE PERSONNEL ONLY

ADJUSTMENTS

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VIDEO PEAKING CONTROL (located on Video Out Panel "M")

The video peaking control should normally be set in maximum clockwise position for optimum video response. If high frequency background noise is visible on CRT, turn video peaking control counter-clockwise to eliminate the background noise.

HUE RANGE ADJUSTMENT (Coil L-4S located on color panel "S". See control and panel location detail on chassis)

1. Tune receiver to a color telecast.
2. Set hue and tint control to mid-mechanical position.
3. Adjust color oscillator output coil (3.58 oscillator amplifier) L-4S for correct flesh tones.

TINT CONTROL

The tint control serves a dual purpose; on black and white, it is normally set to approximately the center of its range. On color programs, it is adjusted toward the right (clockwise) position for best flesh tones (see Owners Manual).

HORIZONTAL & VERTICAL PINCUSHION CORRECTION (Controls located on Pincushion Panel "G")

Horizontal Procedure

Connect crosshatch generator to receiver input.

1. Reduce BRIGHTNESS control until raster is just visible.
2. Adjust HORIZONTAL PINCUSHION control until the side vertical lines just become straight.

Vertical Procedure

1. Adjust BOTTOM PINCUSHION control to maximum counter-clockwise.
2. Adjust TOP PINCUSHION control (coil for maximum downward bow at center and bottom of raster.
3. Adjust BOTTOM PINCUSHION control clockwise for straight horizontal lines at bottom of raster.
4. Readjust the TOP PINCUSHION coil for straight horizontal lines at top of raster.
5. Repeat Steps #3 and #4 to optimize correction at top and bottom of raster.

AGC (AUTOMATIC GAIN CONTROL) ADJUSTMENT PROCEDURE (Control located on Video Amplifier Panel "E")

NOTE: The AGC control is accurately adjusted at the factory. Avoid unnecessary adjustment.

be misadjusted. Set RF AGC delay cont
to center of its range and repeat Steps #
thru #3.

4. Re-set NOISE GATE control. Turn cont
clockwise until picture becomes unstable
starts to pull horizontally, then back off
control until picture is stable.

NOTE: If either control will not cause p
ture to become unstable or pull horizo
tally, leave control(s) at maximum setti
Check picture content for busy backgrou
or interference. If either is present, adj
RF AGC DELAY control and repeat Steps
thru #4.

VHF RF AGC (AUTOMATIC GAIN CONTROL) DELAY (Control located on IF Panel "B")

NOTE: This control is factory pre-set a
normally should not require adjustment. T
RF AGC DELAY control should be adjust
if picture overloading is evident and cann
be corrected with AGC control, if pictu
exhibits busy background, or apparent
interference caused by cross modulation
VHF tuner.

Adjustment Procedure

1. Tune receiver to a medium or weak s
tion.

2. Turn control CW until noise or bu
background is evident in picture. Then tu
control CCW until noise disappears or
minimized.

While turning control to left (CCW), if
interference appears in picture, back off
control and set to position giving least ba
ground noise and interference. If control h
no apparent effect, leave in maximum (C
position.

After the RF AGC DELAY control has be
adjusted, the IF AGC control should also
re-adjusted. It may be necessary to repe
the RF and IF AGC adjustments to optim
the tuner and IF performance.

GENERAL CONVERGENCE PROCEDURE

The following eight steps outline, in gene
the complete step by step convergence p
cedure that follows:

1. Demagnetize shadow mask with
gaussing coil.
2. DC converge all three colors in cen
area of screen.
3. Adjust purity ring for center screen a
red, adjust yoke position for outer area r
4. Set tint control to its mechanical cen
and set black and white brightness tracki
5. Properly center and size picture.
6. Dynamically converge all three colors
7. Recheck Steps #2 and #3.
8. Repeat Step #4.

PURITY & CONVERGENCE PROCEDURE

MODEL TM706S, KM13S

MOTOROLA service manual

GENERAL INFORMATION

Universal 8 track car stereo tape cartridge player designed for 12 volt negative ground installations.

Model KM13S is a rear door speaker kit for this model.

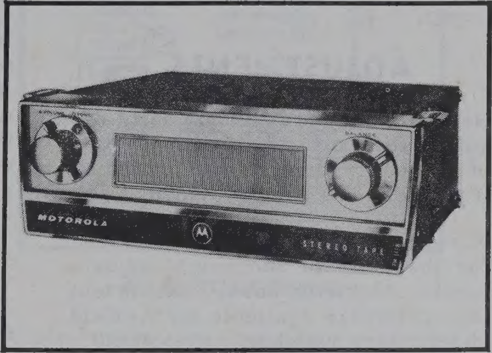
WARRANTY SERVICE STATION PROCEDURE

1. A Motorola Branded Model is one that has the Motorola name and is distributed to dealers through the Motorola Distributors.

2. This model is guaranteed for all parts and labor, including removal and re-installation (R & R) for a period of one (1) year from the date of purchase. The following repairs are not covered under this guarantee: the elimination of motor noise, tire static, electrical interference and faulty installation. Charges for these repairs are to be paid by the customer.

3. Before performing a guarantee repair on a Motorola Branded Auto Tape Player, you must first receive the Customer's Guarantee and Service Booklet. The installation and model information on the booklet must be filled in by the selling dealer at the time of retail sale. The Customer's Guarantee and Service Booklet must show that the tape player is within the guarantee period to be repaired under the Motorola Guarantee.

4. To obtain your labor allowance for the servicing of the customers in-guarantee set, fill in the Motorola Guarantee Labor Claim, Part No. 68P60016A30. If you perform a R & R service, you are entitled to the R & R allowance. If you only repair the tape player without R & R service, you are entitled to the labor allowance. However, if you perform both R & R and the repair, then be sure to indicate both on your claim form for both allowances. After the form has been filled in, mail the pink and green copies to your Motorola Distributor for payment. The yellow copy is to be retained in the service station file.



5. Defective parts for guarantee repairs made are to be sent to your Motorola Distributor for free replacement supported with the defective parts return tag, Part Number 54P591808.

6. Only those service stations authorized by their Motorola Distributor can perform repairs within the guarantee period on a no-charge basis to the customer. If you are not an Authorized Motorola Auto Radio Service Station and you are interested in handling this service, please contact your Motorola Distributor for complete details.

OPERATING INSTRUCTIONS

OPERATION

TO PLAY TAPES - Turn unit on by rotating the on-off and volume knob to the right. Select a tape cartridge and insert it - label side up and open end first - into the tape slot. Push the cartridge in until it is firmly seated. (THIS IS IMPORTANT.) The tape cartridge will now play, in succession, all four programs. Adjust volume, tone and balance as required.

CAUTION: The tape cartridge should always be pulled out completely or approximately 1" from the seated (play) position before leaving car.

TAPE CARTRIDGE CARE

To assure maximum life and noise free operation, tapes should be stored in a cool, clean and dry place, out of the rays of the sun and with the open (tape) end down.

SERVICE NOTES

1. POLARITY - WHEN SERVICING THIS UNIT, THE "A" LEAD MUST BE CONNECTED TO THE POSITIVE SIDE OF POWER SOURCE. IF CONNECTED OTHERWISE, UNIT WILL NOT OPERATE AND DAMAGE TO COMPONENTS MAY RESULT.

2. POWER SUPPLY REQUIREMENTS - It is preferable to use a storage battery (without a battery charger) in place of a battery eliminator. If a battery eliminator is used, it must be well filtered and regulated.

3. OUTPUT LOAD - Always operate this unit with an output load across each of the two channels; either 8 ohm speakers or 8 ohm, 5 watt resistive loads can be used.

4. TRANSISTOR REPLACEMENT - When replacing a transistor other than a power or regulator transistor, grasp the transistor leads between transistor body and plated chassis board with a pair of long nose pliers to prevent excessive heating of transistor body during soldering operation.

5. POWER AND REGULATOR TRANSISTOR REPLACEMENT - When replacing a power or regulator transistor, be sure to:

A. Use the transistor specified in the Replacement Parts List.

B. Coat both sides of transistor insulator with DC-4 grease (Motorola Part No. 11M490487) to insure proper heat dissipation.

C. Securely and evenly tighten the transistor mounting screws.

6. GAINING ACCESS TO THE PLATED BOARDS - Remove top and bottom covers and refer to photo on page 5.

Tape Pre-Amp Plated Board - To remove this board for servicing, merely unsolder the chassis ground lead (see photo), bend the copper retaining clip and lift up the chassis to a more serviceable position.

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PART NO. 68P64994A60 2-67 PRICE 35 CENTS
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Sheet 68P65129A70-0

MOTOROLA COLOR TV CHASSIS TS-915 & 919 SERIES

THIS SERVICE INFORMATION IS FOR THE USE OF QUALIFIED SERVICE PERSONNEL ONLY

INSTALLATION AND SERVICE ADJUSTMENTS

AUTOMATIC DEGAUSSER

This receiver is equipped with an automatic built-in degausser. It is a temperature controlled unit and is activated each time the receiver is turned on. The degaussing action takes place within the first second after the receiver is turned on and before the picture comes on. The degaussing action cannot be seen. To degauss after the receiver has been on and has reached its maximum operating temperature, it will be necessary to turn the receiver off and allow it to cool for approximately 5 minutes. If the receiver has been on for only a few minutes, then the required cooling period is reduced.

Upon initial installation, we suggest you degauss the entire receiver and picture tube with a conventional portable degaussing coil.

FOCUSING ADJUSTMENT

Set brightness and contrast for normal picture. Then adjust focus control for best overall focus, center to edge of screen.

DEFLECTION YOKE TILT ADJUSTMENT

Loosen the yoke retainer clamp and rotate yoke until picture is straight. Do not slide yoke forward or backwards on the neck of the tube as purity will be affected. Tighten the clamp screws when adjustment is completed.

PICTURE CENTERING

Vertical and horizontal centering controls are located on the chassis.

NOTE: Large control excursions may affect convergence.

VERTICAL SIZE & LINEARITY (Control located on Convergence Panel "H")

Slight adjustments can be made with the vertical size control without affecting vertical linearity. Large control excursions should only be made prior to convergence.

HORIZONTAL SIZE & HIGH VOLTAGE ADJUSTMENT (Control located on Pincushion Panel "G")

1. Reduce brightness control to minimum. Raster must be extinguished.
2. Meter 2nd anode voltage (2nd anode to chassis ground.)
3. At normal line voltage (122V AC), adjust control for 27Kv.

Alternate Method 1

1. Use a variable AC source (variac) and adjust input to receiver to 102V AC.
2. Adjust horizontal size (high voltage) control so that the picture just makes horizontal size.

NOTE: At normal line voltage (122V AC) and minimum brightness (raster extinguished), the 2nd anode voltage should not exceed 27Kv.

Alternate Method 2

1. Connect crosshatch generator to receiver antenna terminals.
2. Adjust HORIZONTAL SIZE control to maximum (fully CW).
3. Reduce BRIGHTNESS control until picture is just visible.
4. Adjust HORIZONTAL PINCUSHION CORRECTOR control until the vertical lines on both sides of raster are straight.
5. Set BRIGHTNESS and CONTRAST controls to maximum.
6. Set HORIZONTAL SIZE control to minimum (fully CCW). Then, slowly advance control until the vertical lines on both sides of the raster are straight.

NOTE: At normal line voltage (122V AC) and minimum brightness (raster extinguished), the 2nd anode voltage should not exceed 27Kv.

HORIZONTAL HOLD ADJUSTMENT (Control located on Horiz. Panel "F")

Adjust the horizontal hold for most stable horizontal sync while switching from channel to channel.

FINE TUNING ADJUSTMENT

This receiver employs a VHF tuner with a concentric pre-set fine tuning mechanism.

Rotating the fine tuning knob in either direction automatically engages the fine tuning mechanism and automatically disengages when knob is released.

To fine tune, rotate fine tuning knob in either direction for best picture and sound. Also see AFC ADJUSTMENT.

AFC OPERATION

The AFC is activated by the 45.75Mc carrier in the video IF. The 45.75Mc carrier is amplified and fed to a discriminator transformer tuned to the center frequency of 45.75Mc. Two (2) diodes in the secondary of the discriminator rectify this signal and provide a DC voltage relative to any frequency changes produced by the variation of the 45.75Mc carrier. This DC change is fed to a varactor across the local oscillator in the tuner. The resultant DC correction voltage shifts the oscillator frequency as necessary to maintain the video carrier (45.75Mc) at its proper fine tuned position with respect to the video IF response.

AFC ADJUSTMENT PROCEDURE (Control Locations On AFC Panel)

Check operation of AFC as follows:

Defeat AFC by pulling out on the VHF fine tune knob.

Fine tune to a station for best color picture (just off burble). Push in fine tune knob to activate AFC circuit, the picture should remain the same without severe detuning.

If loss of color or detuning is present, the following adjustments are recommended.

1. Pull out the AFC knob and adjust fine tuning for best color picture.
2. Adjust VTVM for zero center scale.
   TS-919: Connect VTVM to center conductor of the shielded cable attached to *rear of UHF tuner (AFC lead).*
   TS-915: Connect VTVM across AFC switch.
3. Push in AFC knob to activate AFC.
4. Adjust top core of discriminator transformer T1 to top of can.
5. Adjust bottom core to bottom of can.
6. Adjust bottom core to first peak reading on VTVM.
7. Adjust top core for zero center scale on VTVM.
8. Disconnect VTVM and note AFC action, if tuned properly little or no detuning will be noticed on the picture. If detuning is severe, repeat steps 6, 7 and 8.

VIDEO PEAKING CONTROL (located on Video Out Panel "M")

The video peaking control should normally be set in maximum clockwise position for optimum video response. If high frequency background noise is visible on CRT, turn video peaking control counter-clockwise to eliminate the background noise.

HUE RANGE ADJUSTMENT (Coil L-4S located on color panel "S". See control and panel location detail on chassis)

1. Tune receiver to a color telecast.
2. Set hue and tint control to mid-mechanical position.
3. Adjust color oscillator output coil (3.58 oscillator amplifier) L-4S for correct flesh tones.

TINT CONTROL

The tint control serves a dual purpose; on black and white, it is normally set to approximately the center of its range. On color programs, it is adjusted toward the right (clockwise) position for best flesh tones (see Owners Manual).

HORIZONTAL & VERTICAL PINCUSHION CORRECTION (Controls located on Pincushion Panel "G")

Horizontal Procedure

Connect crosshatch generator to receiver input.

1. Reduce BRIGHTNESS control until raster is just visible.
2. Adjust HORIZONTAL PINCUSHION control until the side vertical lines just become straight.

Vertical Procedure

1. Adjust BOTTOM PINCUSHION control to maximum counter-clockwise.
2. Adjust TOP PINCUSHION control (coil for maximum downward bow at center and bottom of raster.
3. Adjust BOTTOM PINCUSHION control clockwise for straight horizontal lines at bottom of raster.
4. Readjust the TOP PINCUSHION coil for straight horizontal lines at top of raster.
5. Repeat Steps #3 and #4 to optimize correction at top and bottom of raster.

AGC (AUTOMATIC GAIN CONTROL) ADJUSTMENT PROCEDURE (Control located on Video Amplifier Panel "E")

NOTE: The AGC control is accurately adjusted at the factory. Avoid unnecessary adjustment.

1. Tune receiver to the strongest station available.
2. Set NOISE GATE control to minimum (fully CCW).
3. Turn AGC control CCW until picture becomes unstable or horizontal pulling is noted.

Then back off on AGC control until picture is stable. Check all channels. Back off further on AGC control if any channel is unstable.

NOTE: If picture seems unstable or exhibits excessive overloading with AGC control at minimum (CW), RF AGC delay control may be misadjusted. Set RF AGC delay control to center of its range and repeat Steps #1 thru #3.

4. Re-set NOISE GATE control. Turn control clockwise until picture becomes unstable or starts to pull horizontally, then back off on control until picture is stable.

NOTE: If either control will not cause picture to become unstable or pull horizontally, leave control(s) at maximum setting. Check picture content for busy background or interference. If either is present, adjust RF AGC DELAY control and repeat Steps #1 thru #4.

VHF RF AGC (AUTOMATIC GAIN CONTROL) DELAY (Control located on IF Panel "B")

NOTE: This control is factory pre-set and normally should not require adjustment. The RF AGC DELAY control should be adjusted if picture overloading is evident and cannot be corrected with AGC control, if picture exhibits busy background, or apparent RF interference caused by cross modulation in VHF tuner.

Adjustment Procedure

1. Tune receiver to a medium or weak station.
2. Turn control CW until noise or busy background is evident in picture. Then turn control CCW until noise disappears or is minimized.

While turning control to left (CCW), if RF interference appears in picture, back off on control and set to position giving least background noise and interference. If control has no apparent effect, leave in maximum (CW) position.

After the RF AGC DELAY control has been adjusted, the IF AGC control should also be re-adjusted. It may be necessary to repeat the RF and IF AGC adjustments to optimize the tuner and IF performance.

NOISE GATE ADJUSTMENT (Control located on Video Amplifier Panel "E")

1. Tune receiver to the strongest station available.
2. Adjust NOISE GATE control clockwise until picture becomes unstable or pulls horizontally. Back off on control until picture is stable.

NOTE: If turning control CW has no effect on picture stability, leave in maximum CW position. If control is adjusted CCW (minimum) and picture is still unstable, adjust IF AGC control.

ABL (AUTOMATIC BRIGHTNESS LIMITER) MASTER BRIGHTNESS ADJUSTMENT PROCEDURE

(Control located adjacent to Convergence Panel "H")

Because of the DC coupling utilized in this receiver, an increase of video produces an increase of brightness. The ABL circuit helps maintain the proper ratio of DC to video. The ABL circuit also limits the CRT beam current, resulting in longer CRT life and protects the high voltage supply from drawing excessive current.

ABL Set-Up

1. Set brightness and contrast control to maximum.
2. Set channel selector between channels.
3. Connect a VOM (As described below)

CHASSIS TS 915/919 "C" & Later

TS-915—Measure A.B.L. Voltage from pin 8F (Horiz. panel) to ground. Adjust A.B.L. control for —I.IV.

TS-919—Measure A.B.L. Voltage from set up terminal (located on high Voltage regulator heat sink) to ground.

Adjust A.B.L. Control for —I.IV.

Check if ABL (Master Brightness) control is properly set as follows:

A. Tune in a station.

B. Set contrast and brightness controls for normal viewing. CRT brightness level should be adequate for viewing.

C. Increase brightness control until some highlight blooming is evident. From this point, further increasing the control should not change brightness level or degree of blooming. If blooming is excessive, ABL control is incorrectly set or circuit is not functioning properly.

ALTERNATE ABL (AUTOMATIC BRIGHTNESS LIMITER) SET-UP

The alternate method of ABL set-up in most cases is adequate; however, the previous procedure using the VOM is more accurate and assures optimum DC coupling of the video information to the CRT.

Alternate Set-Up

1. Tune Receiver to a station.
2. Set contrast and brightness controls to maximum.
3. Advance ABL (Master Brightness) control to the point where the picture highlights begin to bloom. Then, back off ABL control to a point just below the point of blooming.

Check if ABL control is properly set as follows:

A. Reduce contrast and brightness control for normal viewing.

B. Increase brightness control until some highlight blooming is evident. From this point, further increase of the brightness control should not change the brightness level or the degree of blooming.

C. If blooming is excessive, repeat Steps #1 thru #3 and check Steps A and B.

CONTROL ADJUSTMENTS UNIQUE TO REMOTE CHASSIS "AD" 25TS-915 ONLY UHF RF AGC DELAY ADJUSTMENT:

Adjustment on weak signal with noise. Stop at point of no noise or minimal noise.

If VHF RF delay is re-adjusted, then UHF RF delay must also be re-adjusted.

If only UHF is available, Do not disturb VHF RF AGC delay control. Adjust UHF RF delay in conjunction with IF AGC control as shown in service adjustments above.

CONVERGENCE PROCEDURE

GENERAL CONVERGENCE PROCEDURE

The following eight steps outline, in general the complete step by step convergence procedure that follows:

1. Demagnetize shadow mask with degaussing coil.
2. DC converge all three colors in center area of screen.
3. Adjust purity ring for center screen area red, adjust yoke position for outer area red.
4. Set tint control to its mechanical center and set black and white brightness tracking.
5. Properly center and size picture.
6. Dynamically converge all three colors.
7. Recheck Steps #2 and #3.
8. Repeat Step #4.

PURITY & CONVERGENCE *PROCEDURE*

PRELIMINARY PURITY ADJUSTMENTS

1. Connect crosshatch generator to antenna terminals and fine tune for best picture. Set brightness and contrast to normal.
2. Convergence panel is accessible from the front of receiver.

Chassis TS-915—Remove two (2) chassis retaining screws and one (1) interlock retaining screw from rear of receiver and pull chassis forward to servicing position. Apply power to secondary service interlock plug located on top of chassis.

Chassis TS-919—Remove speaker panel to gain access to convergence panel G2 and ABL controls. Turn phillips head screw located behind trap door 90° to left to unlock panel.

3. Check adjustment of vertical size and linearity, vertical centering, horizontal centering and center of screen focus.
4. Demagnetize receiver (use degaussing coil around front and all sides of CRT).
5. Turn color intensity control to minimum. Adjust red and green disc magnets for super-imposed red and green pattern at the center of the screen (see Figure #1).
6. Adjust blue disc magnet and blue lateral magnet to place the blue pattern on top of the red and green patterns (see Figure #1).

These preliminary adjustments are necessary to have the three beams in their approximate positions before purity is adjusted.

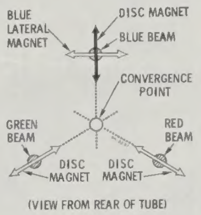


FIGURE 1. STATIC CONVERGENCE

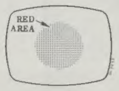
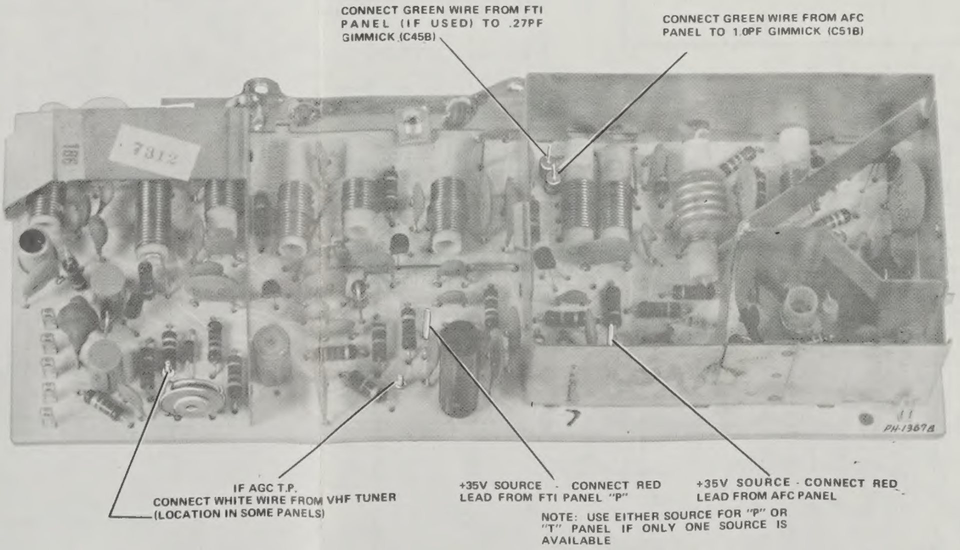


FIGURE 2

PURITY

1. Tune receiver to a blank channel or crosshatch generator pattern having a white background. A white noise free raster can be obtained by setting tuner between channels.
2. Set contrast to minimum, brightness to normal level and tint control to its mechanical center.
3. Turn blue and green G-2 controls to minimum and red G-2 to maximum.
4. Move yoke to obtain pattern as shown in Fig. 2.
5. Starting with the colored or same shaped tabs on the purity ring together (Fig. 4), spread them slowly and rotate the purity ring as a unit to place the red area at the center of the screen. See Fig. 2.
6. Slide yoke toward the original position and position for best overall red field.
7. Level deflection yoke and tighten yoke clamps.
8. Check the purity of the blue and green fields by turning down the red G-2 and turning up the blue and green G-2 controls in turn. Normally, when red field purity is obtained, the green and blue fields are also pure. If either of the fields show impurity, adjust purity ring and/or yoke and then recheck the other two fields.


CONNECT GREEN WIRE FROM FTI PANEL (IF USED) TO .27PF GIMMICK (C45B)
CONNECT GREEN WIRE FROM AFC PANEL TO 1.0PF GIMMICK (C51B)
7312
PH-1367B
IF AGC T.P.
CONNECT WHITE WIRE FROM VHF TUNER (LOCATION IN SOME PANELS)
+35V SOURCE - CONNECT RED LEAD FROM FTI PANEL "P"
+35V SOURCE - CONNECT RED LEAD FROM AFC PANEL
NOTE: USE EITHER SOURCE FOR "P" OR "T" PANEL IF ONLY ONE SOURCE IS AVAILABLE

IF PANEL B-ALTERNATE CONNECTING POINTS

BACKGROUND ADJUSTMENT—GENERAL INFORMATION

(Black-and-white tracking)

The G-2 controls are adjusted to produce a white raster at low brightness setting. The video drive controls are adjusted for a white raster at high brightness level.

CHASSIS TS-915 AND TS-919

Set G-2 controls to mid-mechanical position. Make adjustment at low brightness level. Leave the G-2 control of the gun with the lowest emission at mid-range. Adjust the other two G-2 controls to match the gun with the lowest emission.

Check the range of the BRIGHTNESS control. At minimum brightness setting the raster should be extinguished. While advancing BRIGHTNESS control toward maximum, a point will be reached where the brightness should reach a sufficient intensity for viewing accompanied by slight blooming. The brightness level of blooming should not increase when the brightness control is advanced further. If severe blooming occurs at maximum brightness, leave brightness control at maximum and reduce ABL control just below the point of blooming. If there is insufficient brightness at maximum brightness control setting, increase ABL control setting to achieve sufficient brightness just below blooming.

After the background has been adjusted, readjust the ABL control as described in ABL set-up procedure.

BACKGROUND ADJUSTMENT PROCEDURE (Control Locations: Video Drive Controls on Video Drive Panel "M"; near Convergence Panel "H")

1. Tune in a black-and-white picture. Set intensity control to minimum if black-and-white picture is not available.
2. Set TINT control to mid-range.
3. Set VIDEO DRIVE controls to maximum (CW).
4. Set G-2 controls to mid-mechanical range. Perform steps 6, 7, 8 & 9.

5A. Set BRIGHTNESS and CONTRAST controls to minimum (CCW). If there is no raster, proceed with Step #5B. If there is a raster, increase BRIGHTNESS control (if necessary) until all three guns are on. Turn G-2 control of corresponding predominant color to minimum. Next, turn G-2 control of the next predominant color to minimum. Leave the remaining G-2 control at maximum. Reduce BRIGHTNESS control so that raster is just visible. Adjust the other two G-2 controls to produce a white raster. Proceed with Step #7.

5B. Increase BRIGHTNESS control until one of the guns just produces a raster. Turn G-2 control of this gun to minimum. Again increase brightness until the next gun just produces a raster. Turn G-2 control of this gun to minimum. Continue to increase brightness until the remaining gun just produces a raster. Leave brightness setting at this level. Adjust the G-2 controls of the other two guns to produce a white raster. Proceed with Step #7.

6. With G-2 controls set at mid-range, determine which gun has the least emission and leave this G-2 control in mid-range position. Adjust the other two G-2 controls to produce a white raster. Proceed with Step #7.

7. Set CONTRAST and BRIGHTNESS control to maximum. Reduce the DRIVE controls corresponding to the predominant color to produce white picture highlights.

NOTE: Leave the DRIVE control of the least predominant color at maximum.

8. Repeat applicable Steps #3 thru #7 as necessary until low to high level tracking is achieved.

9. Adjust ABL (automatic brightness limiter) control as described in ABL set-up procedure.

A. STATIC CONVERGENCE

1. Tune receiver to a white crosshatch and adjust for best picture.

2. Recheck center of screen focus, picture size, linearity and centering of picture, correct if necessary.

3. Adjust the three disc magnets and blue lateral magnet for convergence of all three beams at the center of the screen.

B. DYNAMIC CONVERGENCE

Vertical Dynamics

NOTE: ON SOME RECEIVERS THE CONVERGENCE PROCEDURE ON THE CONVERGENCE PANEL MAY DIFFER FROM THIS PROCEDURE. IF SO, FOLLOW THIS PROCEDURE. USE CONTROL IDENTIFICATION RATHER THAN NUMBER SEQUENCE. CONTROL LOCATION IS IDENTICAL.

NOTE: The arrows shown on the convergence panel diagram indicate the normal movements of the converging lines with associated controls.

Obtain a red-green raster by turning blue G-2 to minimum. Use Figure #5, the convergence panel diagram, and observe the affect as illustrated at each control.

1. Adjust R-G vertical amplitude to converge the center vertical line at bottom of screen (Step #1).

2. Adjust R-G vertical tilt to converge the center vertical line at top of screen (Step #2).

NOTE: If the range of the R-G vertical amplitude and tilt controls is inadequate, move the black wire to its opposite position (terminal #6 or #7 on transformer) as indicated on the legend side of convergence panel.

Alternately repeat Steps #1 and #2 for best convergence at top and bottom of center vertical line. Best convergence is obtained by super-imposing the lines from the center outward. However, the proper adjustment of these controls may result in the red and green lines being parallel. If this condition exists, converge the lines by using the disc magnets.

3. Adjust the R-G vertical differential amplitude control to converge a horizontal line near the bottom of the screen (Step #3).

4. Adjust the R-G vertical differential tilt to converge a horizontal line near the top of the screen (Step #4).

If the horizontal lines in the center of the screen are misconverged, repeat Steps #3 and #4 for equally spaced horizontal lines from top to bottom of screen. Readjust disc magnets if necessary. Readjust the R-G vertical amplitude and tilt controls (Steps #1 and #2) for center vertical lines, if necessary.

Horizontal Dynamics

Turn off the blue G-2 leaving the red and green fields on the screen.

5. Adjust the right-side R-G vertical line control to make the vertical lines from the center to the right side converge (Step #5).

6. Adjust the left-side R-G vertical line control to make the vertical lines from the center to the left side converge (Step #6).

Retouch the right and left R-G vertical line controls for best overall convergence of the vertical lines or for an error that lends itself to correction by the disc magnets.

7. Pre-adjust R-G differential tilt control (#8) to center of range. Adjust horizontal line control (#7) to make R-G center lines converge. Any remaining displacement at either side of the screen should be equal and exist in the same direction.

8. Adjust horizontal differential tilt control to make the center horizontal R-G lines converge in the center of the screen or be equal in displacement to permit convergence with the disc magnets. It may be necessary to readjust between Steps #7 and #8 to completely converge center line across the screen.

Repeat Steps #5, #6, #7 and #8 for best overall convergence, or for equal spacing of lines which can be corrected with the disc magnets.

Blue Horizontal Dynamics

9. Turn up the blue G-2 control and increase the blue horizontal amplitude to maximum (Step #9).

10. Adjust the blue horizontal tilt control until the droop in the blue line is in the center of the screen (Step #10).

11. Adjust the blue horizontal phase until the droop in the blue line is forced upward (Step #11).

12. Re-adjust blue horizontal amplitude control (#9) until blue line is converged on R-G line along a center horizontal line or for equal displacement to permit convergence with the disc magnets (Step #12).

Blue Vertical Dynamics

13. Initially set Blue Vert Amplitude control (14) to near max. (cw). Adjust Blue vertical tilt control (13) to produce equal displacement in the same direction of the Blue horizontal lines with respect to red and green at the top and bottom of screen. (Step #13).

14. Adjust the Blue vertical amplitude control (14) in conjunction with the Blue vertical tilt control (13) to converge blue with R-G at top, center and bottom of the screen.

NOTE: If the range of the blue vertical amplitude and tilt controls is inadequate, reverse the positioning of the brown and blue jumpers as indicated on the legend side of convergence panel.

NOTE: If the displacement of the blue line is not equal on both ends with respect to R-G line, readjust blue horizontal tilt control (Step #10).

Repeat Steps #10, #11 and #12, if necessary, to get a satisfactory convergence along a center horizontal line or to get equal displacement to permit correction with the disc magnets.

15. Re-check disc magnets. The pattern should now be converged.

The G-2 controls should now be reset for a white background. Generally, since the blue G-2 is the only one disturbed, it is possible to set this control at its proper adjustment at low brightness while observing a local station.

IF THE PURITY RING IS RE-ADJUSTED FOR ANY REASON, THE ENTIRE CONVERGENCE PROCEDURE MUST BE REPEATED.

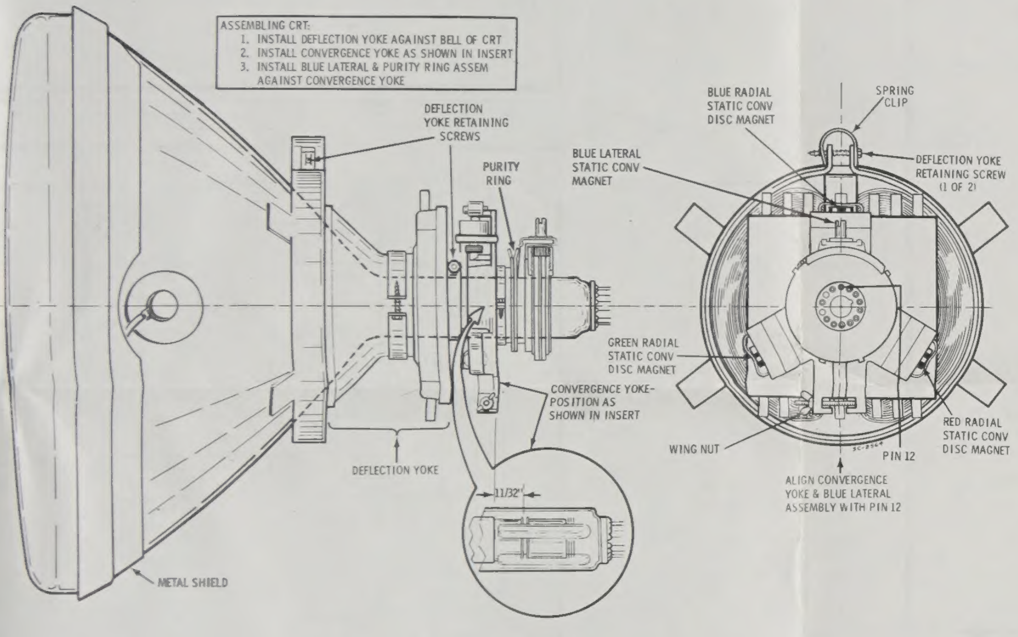
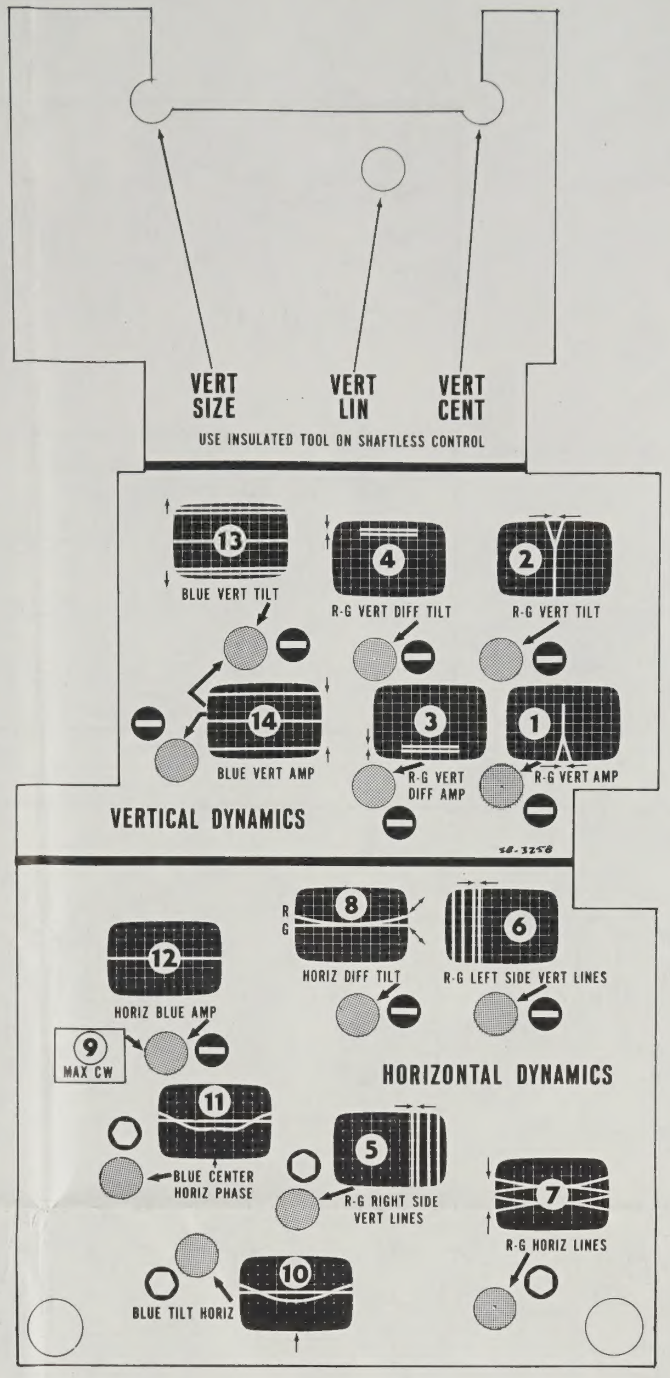

ASSEMBLING CRT:
1. INSTALL DEFLECTION YOKE AGAINST BELL OF CRT
2. INSTALL CONVERGENCE YOKE AS SHOWN IN INSERT
3. INSTALL BLUE LATERAL & PURITY RING ASSEM AGAINST CONVERGENCE YOKE
DEFLECTION YOKE RETAINING SCREWS
PURITY RING
BLUE LATERAL STATIC CONV MAGNET
BLUE RADIAL STATIC CONV DISC MAGNET
SPRING CLIP
DEFLECTION YOKE RETAINING SCREW (1 OF 2)
GREEN RADIAL STATIC CONV DISC MAGNET
CONVERGENCE YOKE-POSITION AS SHOWN IN INSERT
RED RADIAL STATIC CONV DISC MAGNET
WING NUT
PIN 12
ALIGN CONVERGENCE YOKE & BLUE LATERAL ASSEMBLY WITH PIN 12
DEFLECTION YOKE
11/32"
METAL SHIELD

FIGURE 4. COLOR TUBE ASSEMBLY

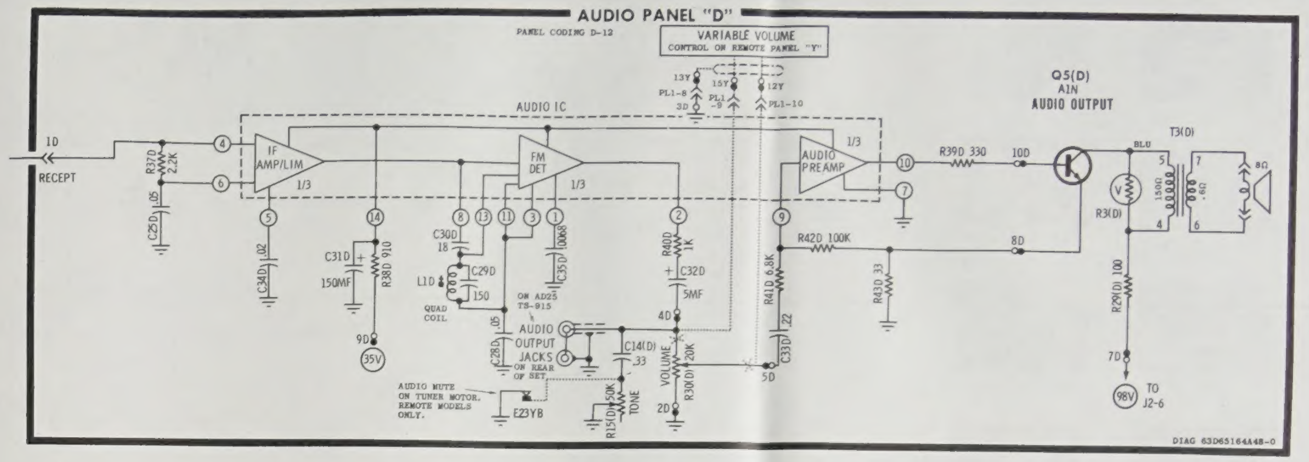

VERT SIZE
VERT LIN
VERT CENT
USE INSULATED TOOL ON SHAFTLESS CONTROL
13
BLUE VERT TILT
4
R-G VERT DIFF TILT
2
R-G VERT TILT
14
BLUE VERT AMP
3
R-G VERT DIFF AMP
1
R-G VERT AMP
VERTICAL DYNAMICS
12
HORIZ BLUE AMP
8
HORIZ DIFF TILT
6
R-G LEFT SIDE VERT LINES
9
MAX CW
HORIZONTAL DYNAMICS
11
BLUE CENTER HORIZ PHASE
5
R-G RIGHT SIDE VERT LINES
7
R-G HORIZ LINES
10
BLUE TILT HORIZ

CONVERGENCE PANEL—FRONT VIEW

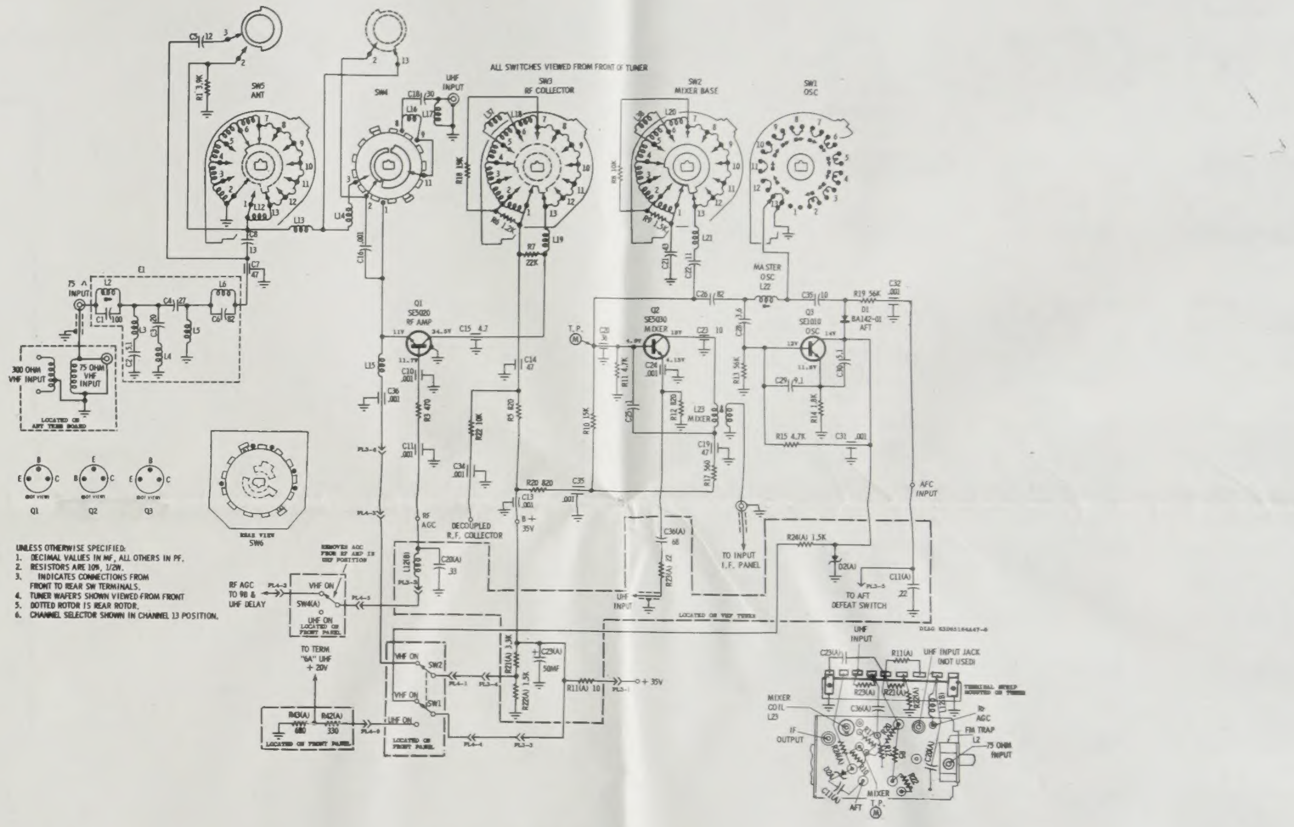
NOTE: THE CONVERGENCE PROCEDURE SEQUENCE MAY DIFFER FROM THAT SHOWN ON SOME CONVERGENCE PANEL DETAILS (ON RECEIVER). FOLLOW PROCEDURE OUTLINED HERE. CONTROL LOCATION IS IDENTICAL.

FIGURE 5

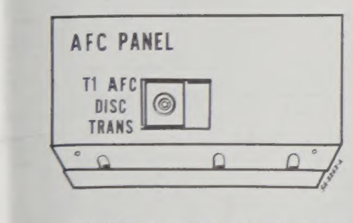
AUDIO PANEL AND TUNERS USED IN AD25 TS-915


AUDIO PANEL "D"
PANEL CODING D-12
VARIABLE VOLUME CONTROL ON REMOTE PANEL "Y"
AUDIO IC
IF AMP/LIM
FM DET
AUDIO PREAMP
Q5(D) A1N AUDIO OUTPUT
T3(D)
RECEPT
AUDIO OUTPUT JACKS ON REAR OF SET
VOLUME

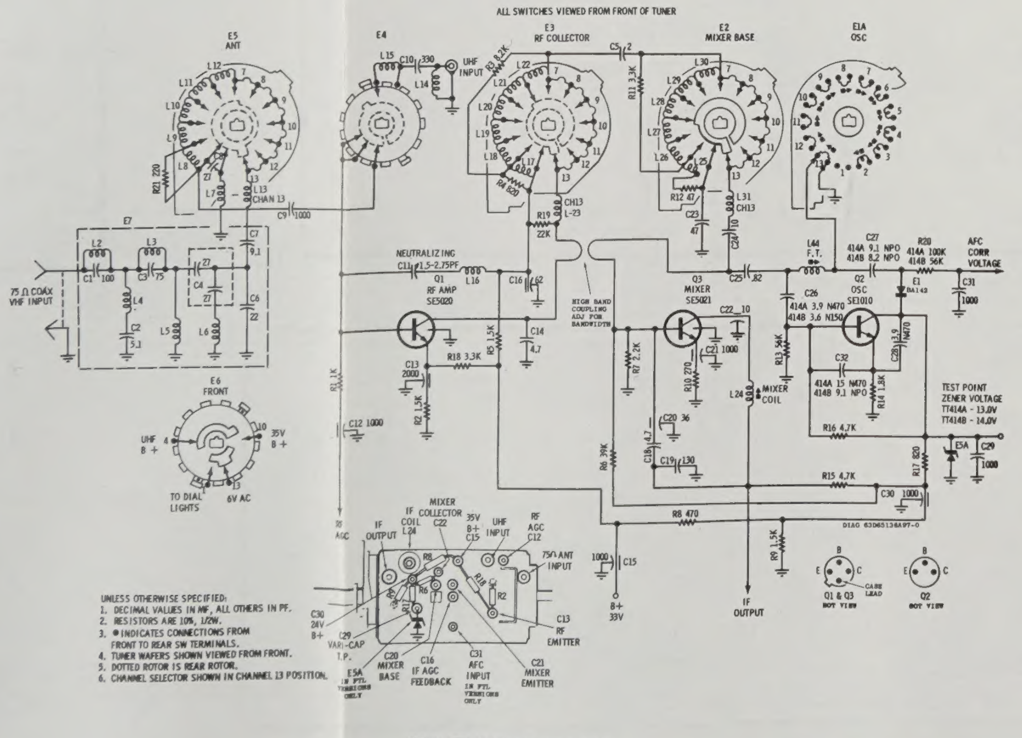
AUDIO PANEL CIRCUIT FOR PANELS CODED D-12


ALL SWITCHES VIEWED FROM FRONT OF TUNER

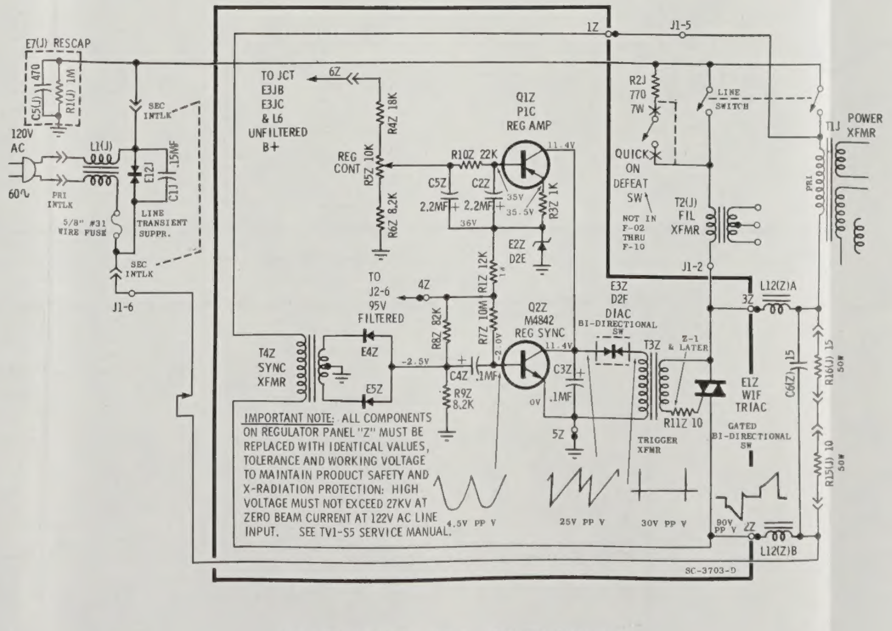
VHF TUNER AOPTT 432


AFC PANEL
T1 AFC DISC TRANS

TS-915 & TS-919 (AFC) PANEL CONTROL AND ADJUSTMENT LOCATION

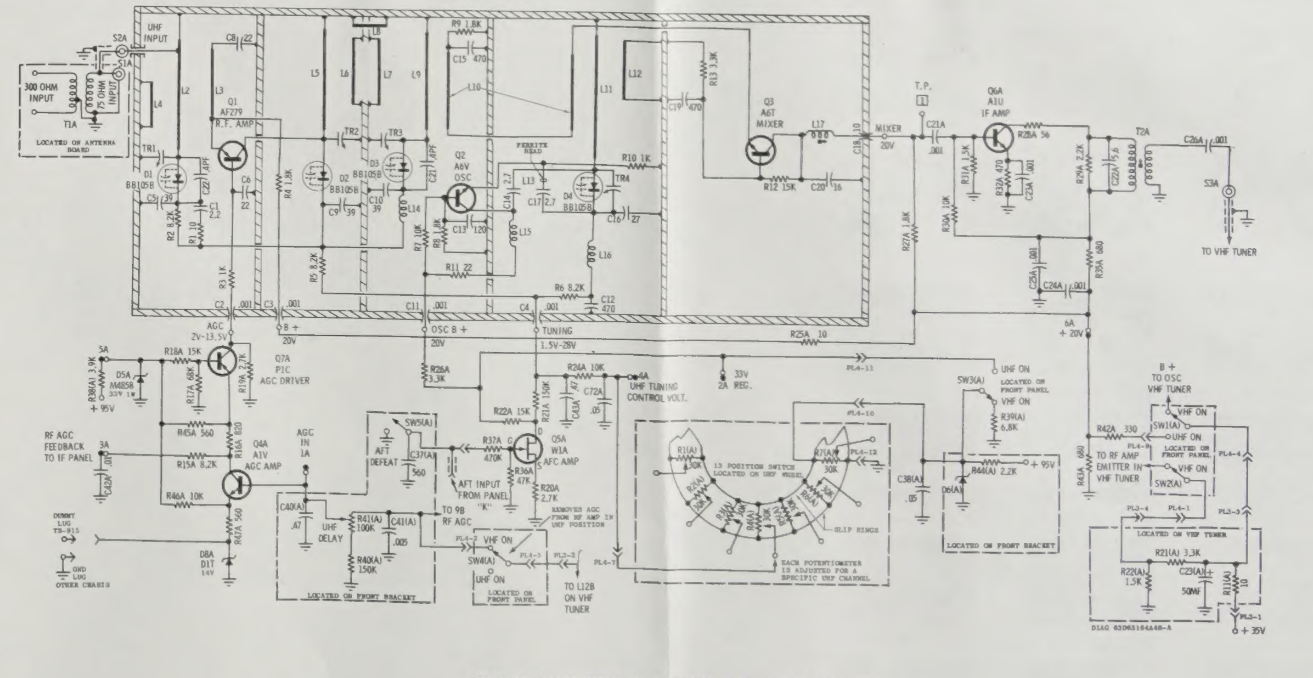

ALL SWITCHES VIEWED FROM FRONT OF TUNER
E3 RF COLLECTOR
E2 MIXER BASE
E1A OSC
UNLESS OTHERWISE SPECIFIED:

VHF TUNER OPTT 414


IMPORTANT NOTE: ALL COMPONENTS ON REGULATOR PANEL "Z" MUST BE REPLACED WITH IDENTICAL VALUES, TOLERANCE AND WORKING VOLTAGE TO MAINTAIN PRODUCT SAFETY AND X-RADIATION PROTECTION: HIGH VOLTAGE MUST NOT EXCEED 27KV AT ZERO BEAM CURRENT AT 122V AC LINE INPUT. SEE TV1-S5 SERVICE MANUAL.
E7(J) RESCAP
120V AC
Q1Z P1C REG AMP
Q2Z M4842 REG SYNC
T4Z SYNC XFMR
95V FILTERED
QUICK ON DEFEAT SW
T2(J) FIL XFMR
POWER XFMR
LINE SWITCH
E1Z WIF TRIAC
4.5V PP V
25V PP V
30V PP V

AC LINE REGULATED POWER SUPPLY

(In Chassis Coded C25 & AD25TS-915


300 OHM INPUT
UHF INPUT
RF AMP
MIXER
IF AMP

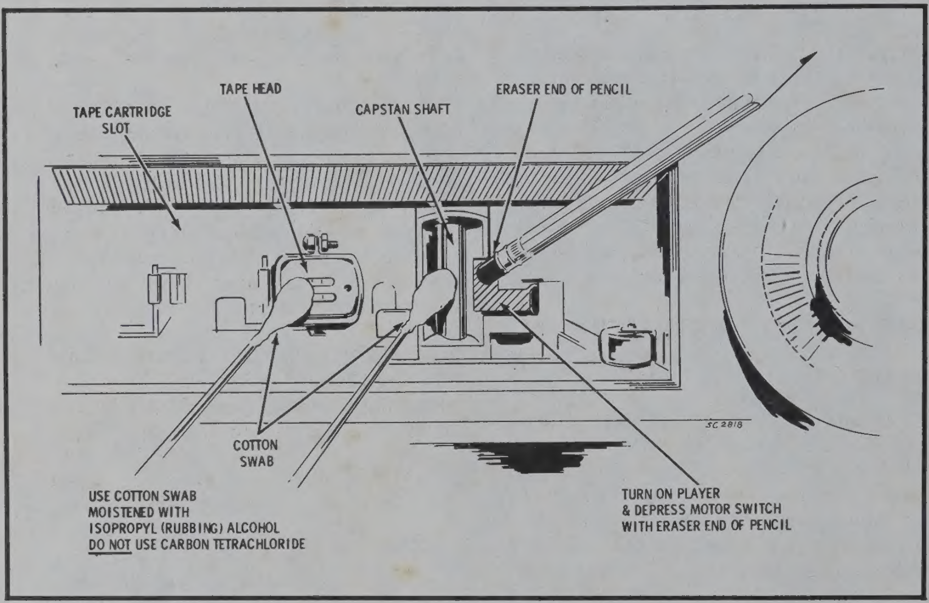
UHF TUNER TT651 CODED A-3 AND LATER

(For Earlier Version See Service Manual CTV1-S5 68P65155A13)

Audio Amplifier Plated Board - To remove the board for servicing, remove the 2 screws from the mounting bracket, then remove the mounting bracket.

7. TAPE CARTRIDGES - Before servicing the tape player portion of this unit, always check for the possibility of a defective pre-recorded tape cartridge, particularily if one is returned with the unit. This should be done by substituting the tape cartridge with one that is known to be good.

8. TAPE HEAD AND CAPSTAN CLEANING - One major cause of improper tape player operation is oxide build-up on the head and capstan. During normal operation, some iron oxide particules are loosened from the tape and build up. This accumulation of oxide can cause poor playback and tape to move up and down. The head and capstan should be cleaned whenever the unit is serviced and this can be done either in the car or on the service bench. To clean the head and capstan, use a cotton swab moistened with head cleaner or isopropyl alcohol, then wipe dry.


TAPE CARTRIDGE SLOT
TAPE HEAD
CAPSTAN SHAFT
ERASER END OF PENCIL
SC 2818
COTTON SWAB
USE COTTON SWAB MOISTENED WITH ISOPROPYL (RUBBING) ALCOHOL DO NOT USE CARBON TETRACHLORIDE
TURN ON PLAYER & DEPRESS MOTOR SWITCH WITH ERASER END OF PENCIL

TAPE HEAD & CAPSTAN CLEANING

9. HEAD DEMAGNETIZING - Do not use magnetized screwdrivers and wrenches near the head since these can magnetize the head. The head may also, after a long period of time, acquire some residual magnetism. A head that is magnetized will show a definite loss of high frequency response and an increase in noise level. Use a commercially available head demagnetizer, following instructions included with the unit to demagnetize the head.

10. HEAD REPLACEMENT - The location of the tape head with respect to its mounting bracket is very critical; for this reason, replacement heads are supplied already secured to their mounting bracket and positioned correctly at the factory. When replacing a head, remember to replace it as an assembly, that is, remove the defective head and bracket and replace it with the new head and bracket assembly.

If for some reason the location of the head has changed (due to a loose mounting screw, etc.), position it as shown in "Head Positioning Adjustment".

ADJUSTMENTS

Head adjustments are normally required for cases of cross-talk, loss of frequency response and noise or if the head has been replaced.

A suitable test tape should be used for the azimuth and height adjustments. Motorola has a suitable test tape cartridge available for the field under Part Number 99P43309A01. Instructions in the form of a label on the cartridge are included.

Connect 8 ohm loads (either speakers or resistors) across the output of both channels and set tone control to treble (maximum clockwise). Use an oscilloscope or AC output meter and a 1/16" Allen wrench for azimuth and height adjustments (Motorola Part Number 66P40059A32).

HEIGHT

This is an adjustment to move the tape head up or down so that it can be positioned exactly in line with the pre-recorded information on the tape. Misadjustment of this screw would cause cross-talk and/or poor separation.

With the Motorola test tape, proceed as follows:

1. Remove top cover and make sure output loads are connected across each channel.

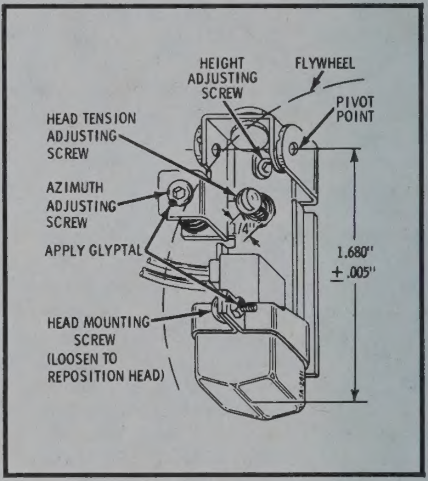
2. Insert test tape cartridge into tape slot and position head to tracks 2 and 6.

3. Set balance control for maximum output from left channel.

4. Connect scope (or VTVM) across left channel output - (track 2 information - 1Kc will be presented). Adjust height adjusting screw for a null. The reason for the null is that the 1Kc information is recorded not on track 2 but on the guard bands adjacent to track 2. This adjustment will minimize cross-talk.

5. Azimuth - Connect scope or VTVM across the output of the right channel and adjust balance control for maximum right channel output - (track 6 information - 8Kc will be presented). Adjust azimuth adjusting screw for maximum output.

Misadjustment of this screw would cause poor high frequency response.



HEAD ADJUSTMENTS

6. Repeat Steps #4 and #5 to optimize these adjustments, then cement adjusting screws in place with glyptal or other non-hardening cement.

The next two adjustments are not normally required except when the head has been replaced or tampered with.

HEAD TENSION ADJUSTMENT

This adjustment will have to be made if the head assembly has been replaced. Adjust the screw so that there is 1/4" between the bottom flat of the screw head and the head mounting bracket with head in its lowest position (tracks 4 and 8). Apply glyptal to the screw from the bottom.

HEAD POSITIONING ADJUSTMENT

Not normally required unless tampering has occurred or if mounting screw has loosened.

The head should be set to 1.680" ±.005" measured from the center of the pivot hole to the front of the head.

Since this dimension is quite critical and may be difficult to gain access to, an alternate method is covered below.

Remove the head and bracket assembly from the tape deck mechanism by first unplugging the cable from the rear of the head, then remove the head tension screw. Loosen the head mounting screw and apply locktite (or other suitable adhesive) to the 4 surfaces of the head where it contacts the bracket. Insert a .082" drill bit (#45 drill) through both pivot holes. With a rule gauge or vernier caliper, adjust the head to 1.721" ±.005" measured from the rear edge of the drill to the front edge of the tape head (see detail). Tighten the head mounting screw and apply glyptal to the mounting nut and screw. Re-install the head and bracket assembly, then adjust the head tension screw to the 1/4" dimension referred to in the detail. Again, apply glyptal to the bottom of this screw. Lastly, perform the azimuth and height adjustments on the head as referred to above.

LUBRICATION

The unit is lubricated at the factory and normally no additional lubrication is required; however, if parts are replaced, the following areas should be lubricated with a light grease such as Plastilube #00.

A. Drive surface of cam.

B. Ball bearing on end of cam.

C. Solenoid plunger.

D. Ball bearings in head mounting bracket.

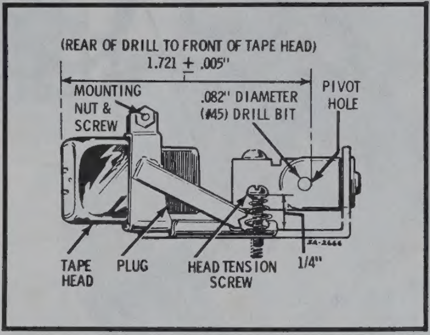
Silicon grease (Dow Corning DC-4 - Motorola Part Number 11M490487) should be applied to the bottom of the capstan shaft.

TAPE PLAYER DRIVE & HEAD POSITIONING

The view shown below is one looking into the tape player from the front with a tape cartridge inserted and operating.

When the tape cartridge is inserted into the tape slot, the front of the tape cartridge activates a microswitch which, in turn, turns on the tape motor and audio circuitry.

The drive belt on the motor shaft drives the flywheel causing it to rotate. The flywheel shaft (capstan) which presses the tape against the rubber pressure roller (inside the cartridge) drives the tape. The tape guide bracket keeps the tape from riding up and down the head.


(REAR OF DRILL TO FRONT OF TAPE HEAD)
1.721 ± .005"
MOUNTING NUT & SCREW
.082" DIAMETER (#45) DRILL BIT
PIVOT HOLE
TAPE HEAD
PLUG
HEAD TENSION SCREW
1/4"

HEAD POSITIONING

Since the pre-recorded tape has four dual channel programs (8 tracks), the head has to be moved to four different height positions with respect to the tape. The sequence of head movement is as follows:

Tracks #1 and #5

Tracks #2 and #6

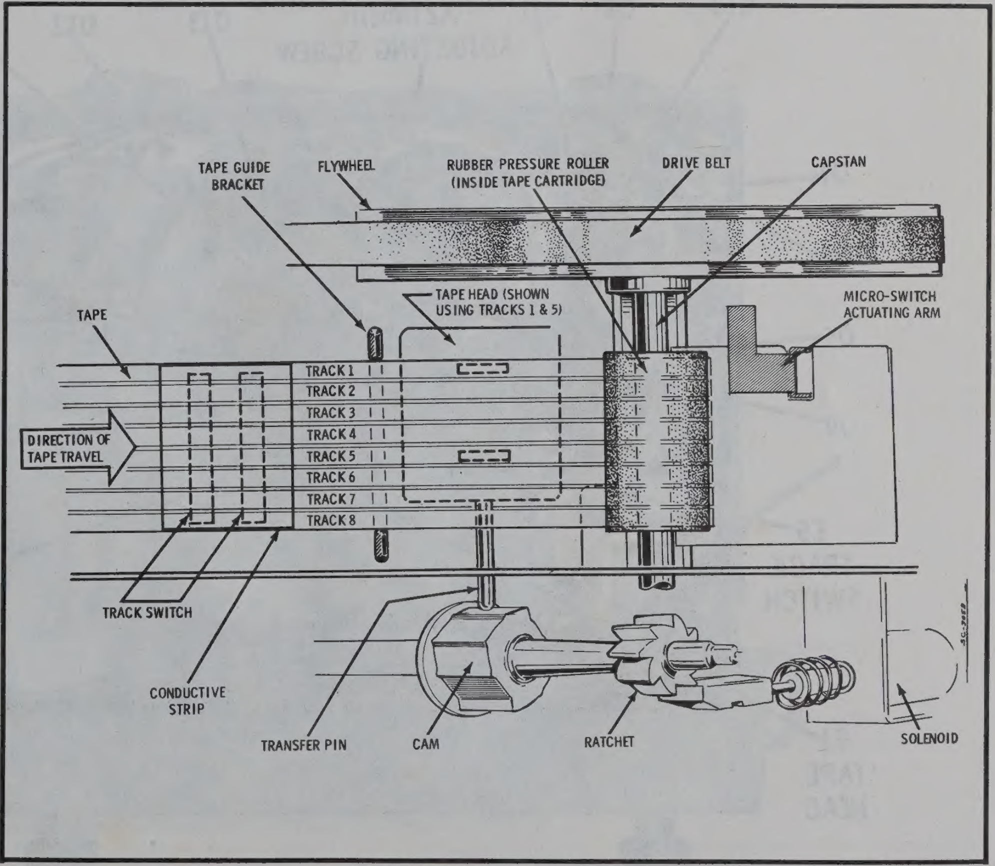
Tracks #3 and #7

Tracks #4 and #8

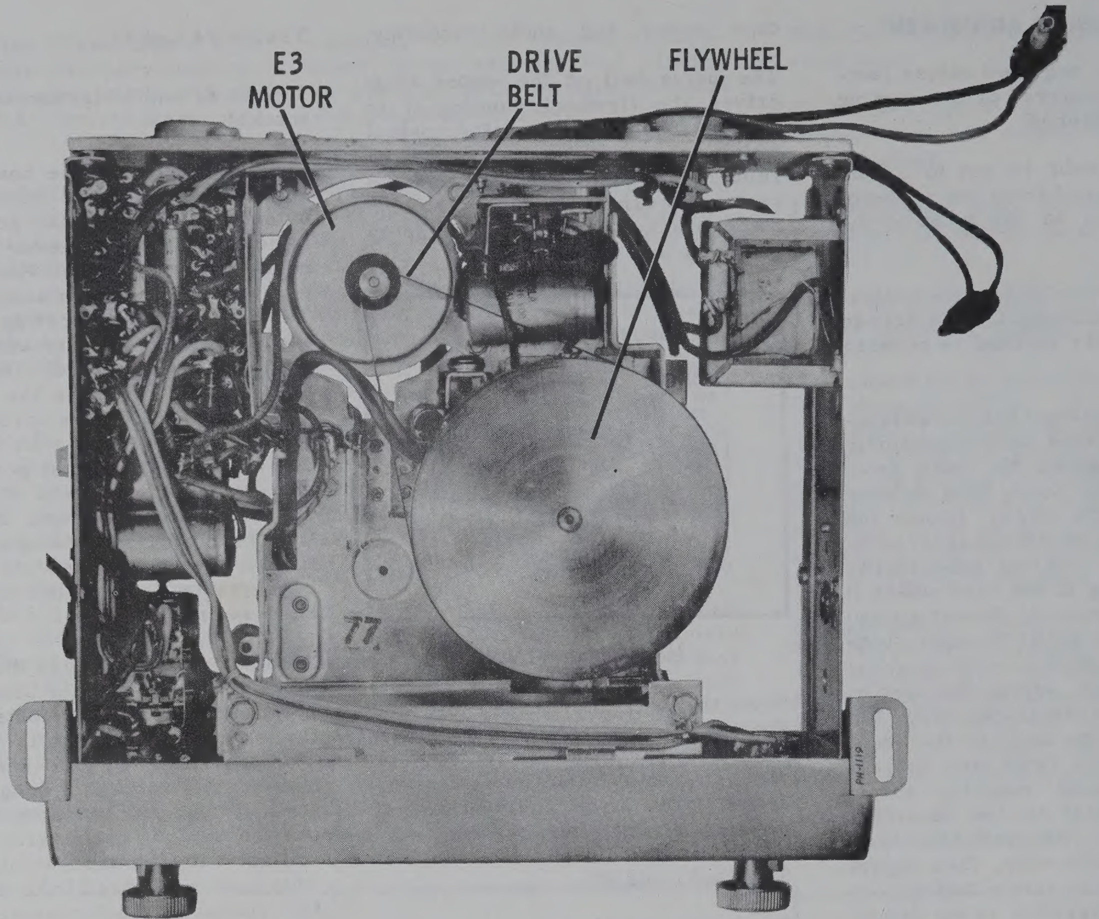
Tracks #1 and #5 (return to original tracks)

The positioning of the head can be accomplished either manually or automatically. Manual positioning is accomplished whenever the channel selector switch (on volume control shaft) is pushed in and released. The momentary shorting of this switch returns one end of the solenoid winding to ground. The resultant magnetic field in the solenoid pulls in the solenoid's spring loaded shaft for an instant; when the shaft returns to its original position, it detents the ratchet end of the cam shaft to its next position. In contact with the irregularly shaped cam is the tape head transfer pin (located beneath the head) which moves the head up or down.

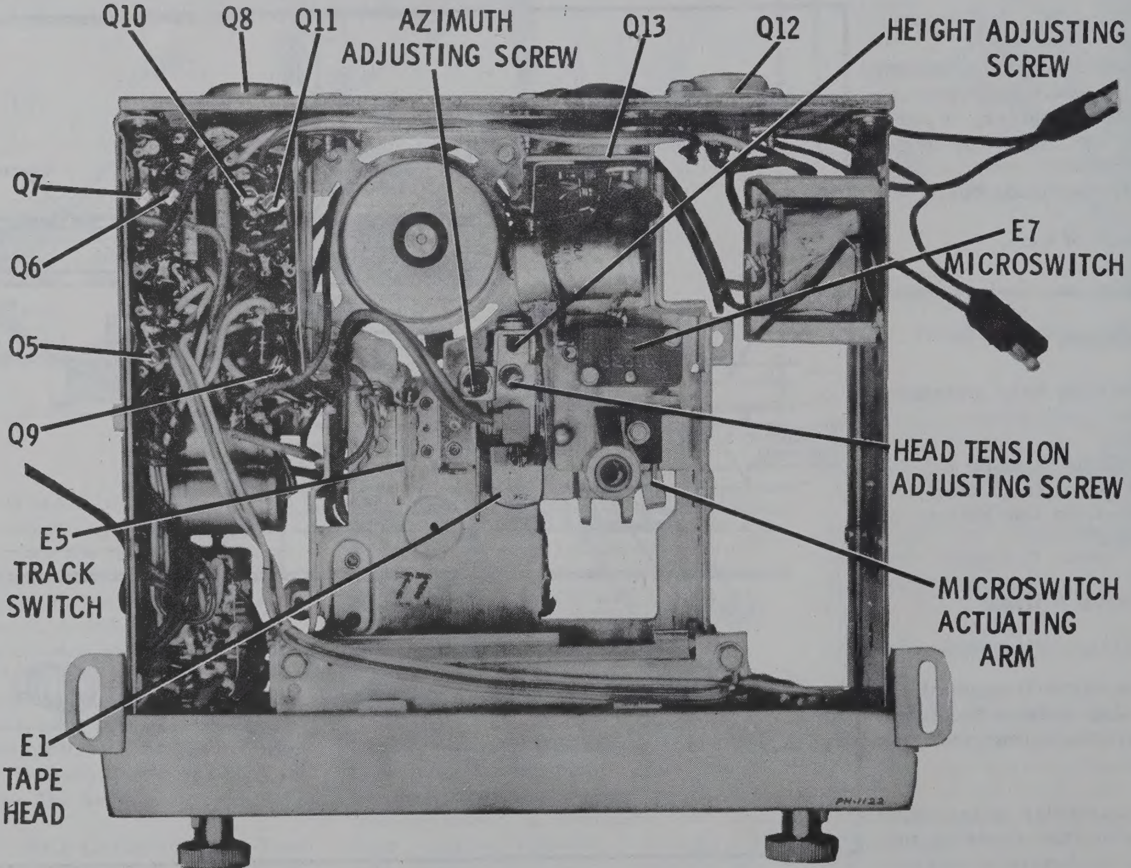
Automatic positioning of the head to the next dual channel program is accomplished by the tape itself when the end of a program is reached. The pre-recorded tape has, at the end of the recorded programs, a strip of conductive tape which shorts out the switch track which is in contact with the tape at all times. This switch is wired in parallel with the channel selector switch which starts the same action that occurred when the channel selector switch was activated.


TAPE GUIDE BRACKET
FLYWHEEL
RUBBER PRESSURE ROLLER (INSIDE TAPE CARTRIDGE)
DRIVE BELT
CAPSTAN
TAPE HEAD (SHOWN USING TRACKS 1 & 5)
MICRO-SWITCH ACTUATING ARM
TAPE
TRACK 1
TRACK 2
TRACK 3
TRACK 4
TRACK 5
TRACK 6
TRACK 7
TRACK 8
DIRECTION OF TAPE TRAVEL
TRACK SWITCH
CONDUCTIVE STRIP
TRANSFER PIN
CAM
RATCHET
SOLENOID

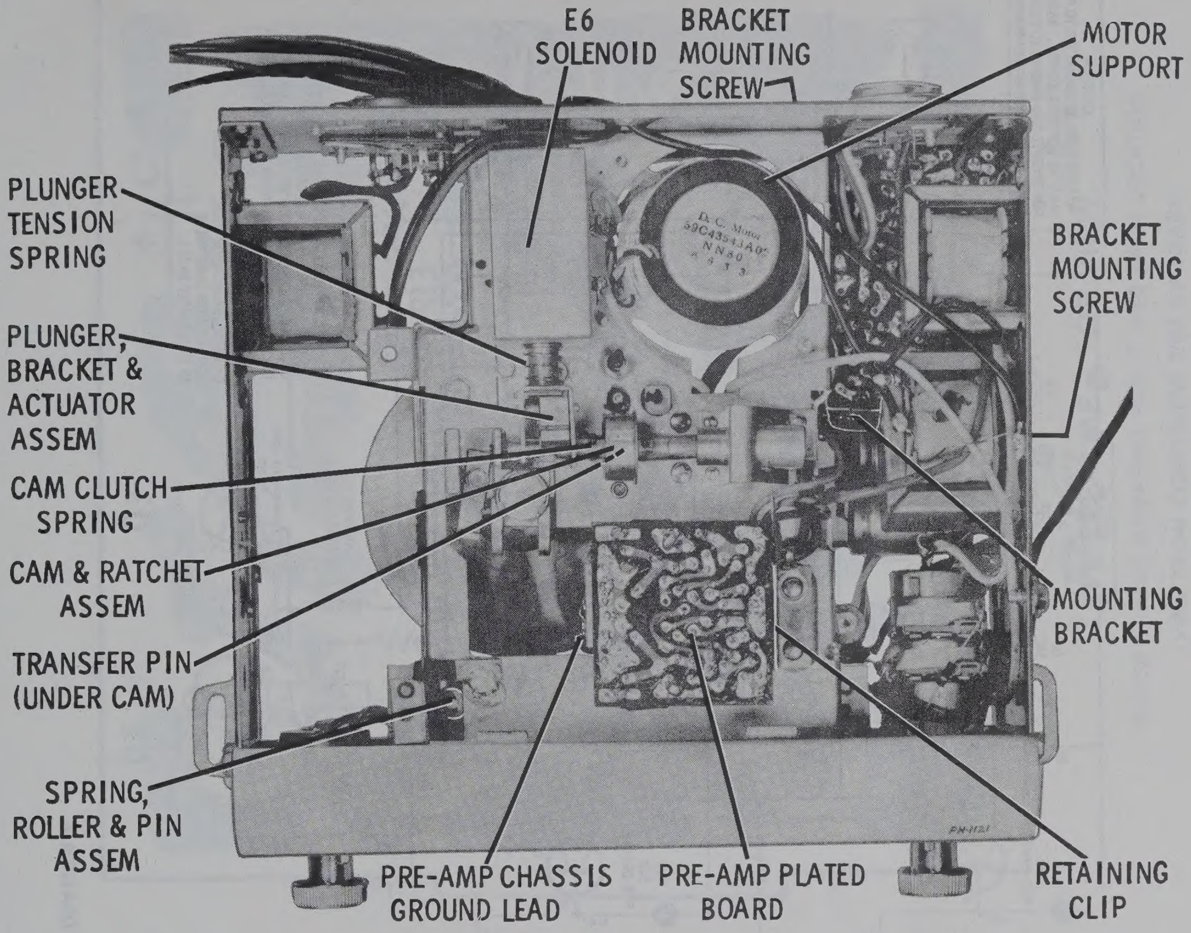
MTD-101 TAPE DRIVE & HEAD POSITIONING


E3
MOTOR
DRIVE
BELT
FLYWHEEL
PH-1119

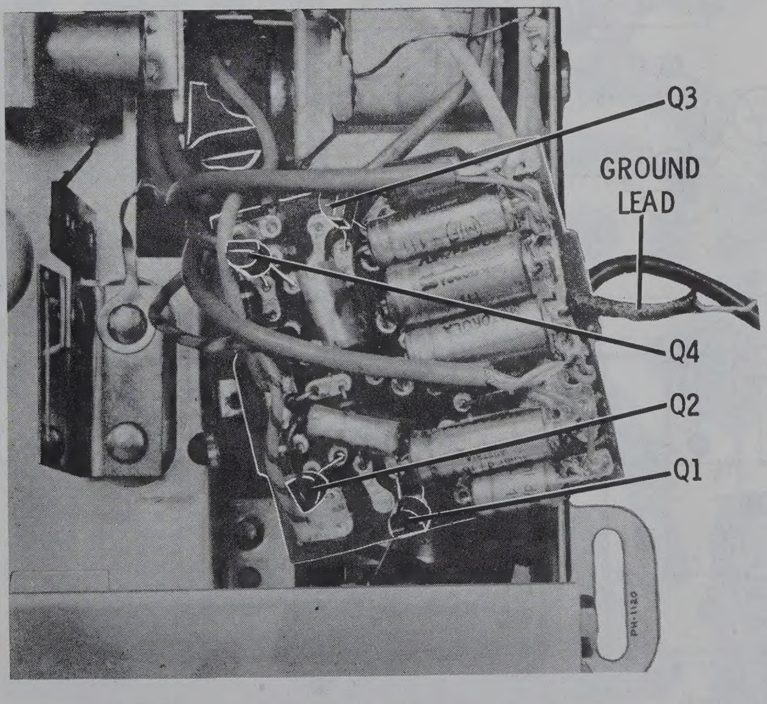
PARTS LOCATION - TOP VIEW


Q10
Q8
Q11
AZIMUTH
ADJUSTING SCREW
Q13
Q12
HEIGHT ADJUSTING
SCREW
Q7
Q6
Q5
Q9
E7
MICROSWITCH
HEAD TENSION
ADJUSTING SCREW
MICROSWITCH
ACTUATING
ARM
E5
TRACK
SWITCH
E1
TAPE
HEAD
PH-1122

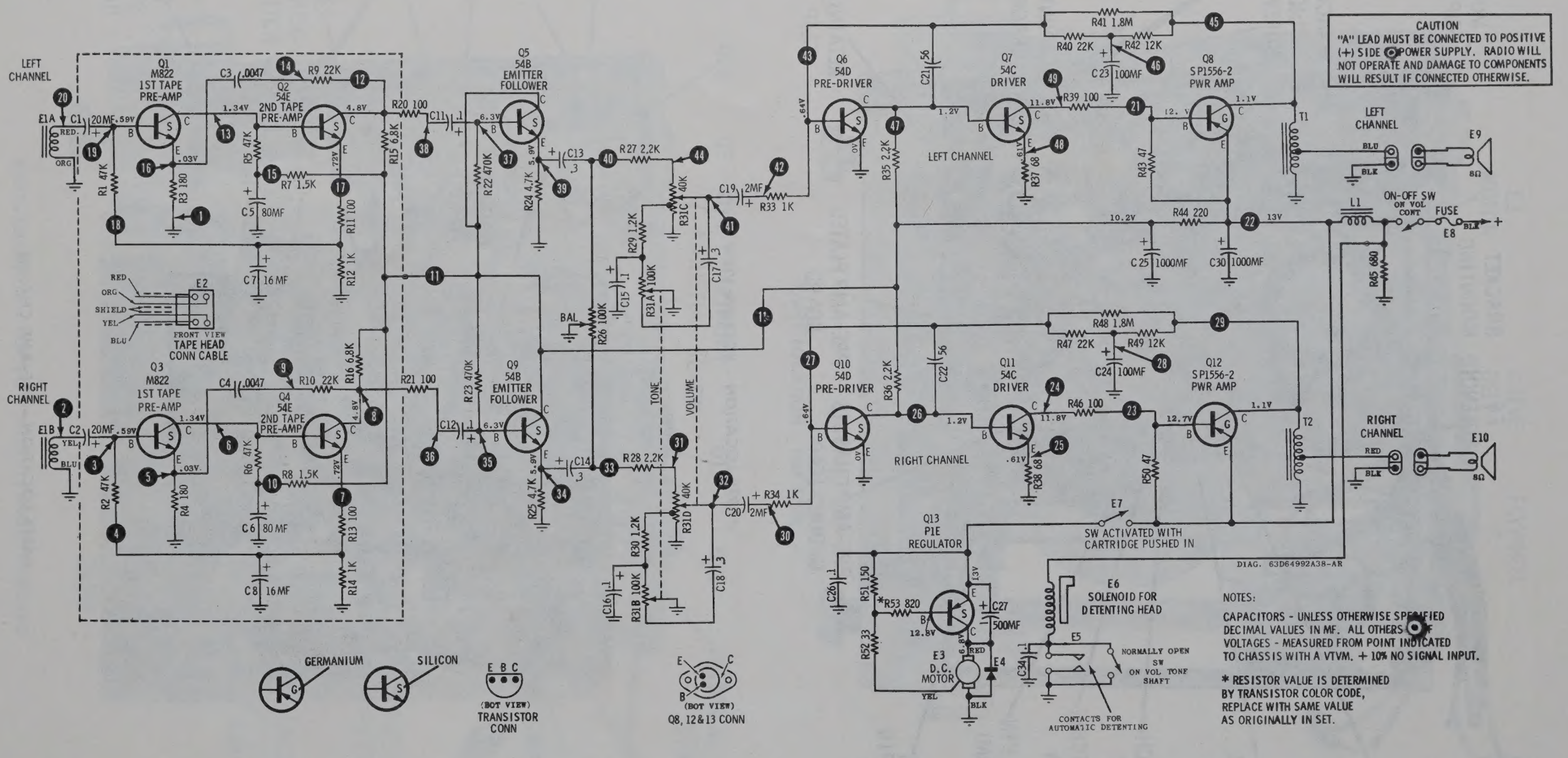
PARTS LOCATION - TOP VIEW WITH FLYWHEEL REMOVED


E6 SOLENOID
BRACKET MOUNTING SCREW
MOTOR SUPPORT
PLUNGER TENSION SPRING
BRACKET MOUNTING SCREW
PLUNGER, BRACKET & ACTUATOR ASSEM
CAM CLUTCH SPRING
CAM & RATCHET ASSEM
TRANSFER PIN (UNDER CAM)
MOUNTING BRACKET
SPRING, ROLLER & PIN ASSEM
PRE-AMP CHASSIS GROUND LEAD
PRE-AMP PLATED BOARD
RETAINING CLIP
PH-1121

PARTS LOCATION - BOTTOM VIEW


Q3
GROUND LEAD
Q4
Q2
Q1
PH-1120

PARTS LOCATION - PRE-AMP CHASSIS


LEFT CHANNEL
E1A
C1 20MF
RED.
ORG
Q1 M822 1ST TAPE PRE-AMP
C3 .0047
R9 22K
Q2 54E 2ND TAPE PRE-AMP
1.34V
4.8V
.59V
.03V
.72V
R1 47K
R3 180
R5 47K
R7 1.5K
C5 80MF
R11 100
R12 1K
C7 16 MF
R15 6.8K
R20 100
C11 .1
RED
ORG
SHIELD
YEL
BLU
E2
FRONT VIEW TAPE HEAD CONN CABLE
RIGHT CHANNEL
E1B
C2 20MF
YEL
BLU
Q3 M822 1ST TAPE PRE-AMP
C4 .0047
R10 22K
Q4 54E 2ND TAPE PRE-AMP
R2 47K
R4 180
R6 47K
R8 1.5K
C6 80 MF
R13 100
R14 1K
C8 16MF
R16 6.8K
R21 100
C12 .1
Q5 54B EMITTER FOLLOWER
6.3V
5.9V
R22 470K
R24 4.7K
C13 3
Q9 54B EMITTER FOLLOWER
R23 470K
R25 4.7K
C14 3
BAL
R26 100K
R27 2.2K
R28 2.2K
R29 1.2K
R30 1.2K
C15 .1
C16 .1
R31A 100K
R31B 100K
R31C 40K
R31D 40K
TONE
VOLUME
C17 3
C18 3
C19 2MF
C20 2MF
R33 1K
R34 1K
Q6 54D PRE-DRIVER
.64V
0V
R35 2.2K
C21 56
Q7 54C DRIVER
1.2V
11.8V
.61V
R37 68
LEFT CHANNEL
R39 100
R40 22K
R41 1.8M
R42 12K
C23 100MF
Q8 SP1556-2 PWR AMP
12. V
1.1V
R43 47
T1
LEFT CHANNEL
BLU
BLK
E9
8Ω
10.2V
R44 220
13V
C25 1000MF
C30 1000MF
L1
ON-OFF SW ON VOL CONT
FUSE
E8
BLK
+
R45 680
Q10 54D PRE-DRIVER
R36 2.2K
C22 56
Q11 54C DRIVER
R38 68
R46 100
R47 22K
R48 1.8M
R49 12K
C24 100MF
Q12 SP1556-2 PWR AMP
12.7V
R50 47
T2
RIGHT CHANNEL
RED
BLK
E10
8Ω
RIGHT CHANNEL
E7
SW ACTIVATED WITH CARTRIDGE PUSHED IN
Q13 P1E REGULATOR
C26 .1
R51 150
*R53 820
R52 33
12.8V
6.8V
C27 500MF
E3 D.C. MOTOR
YEL
RED
BLK
E4
E6 SOLENOID FOR DETENTING HEAD
E5
C34 .1
NORMALLY OPEN SW ON VOL TONE SHAFT
CONTACTS FOR AUTOMATIC DETENTING
DIAG. 63D64992A38-AR
GERMANIUM
SILICON
E B C
(BOT VIEW) TRANSISTOR CONN
E C B
(BOT VIEW) Q8, 12&13 CONN
1
2
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19
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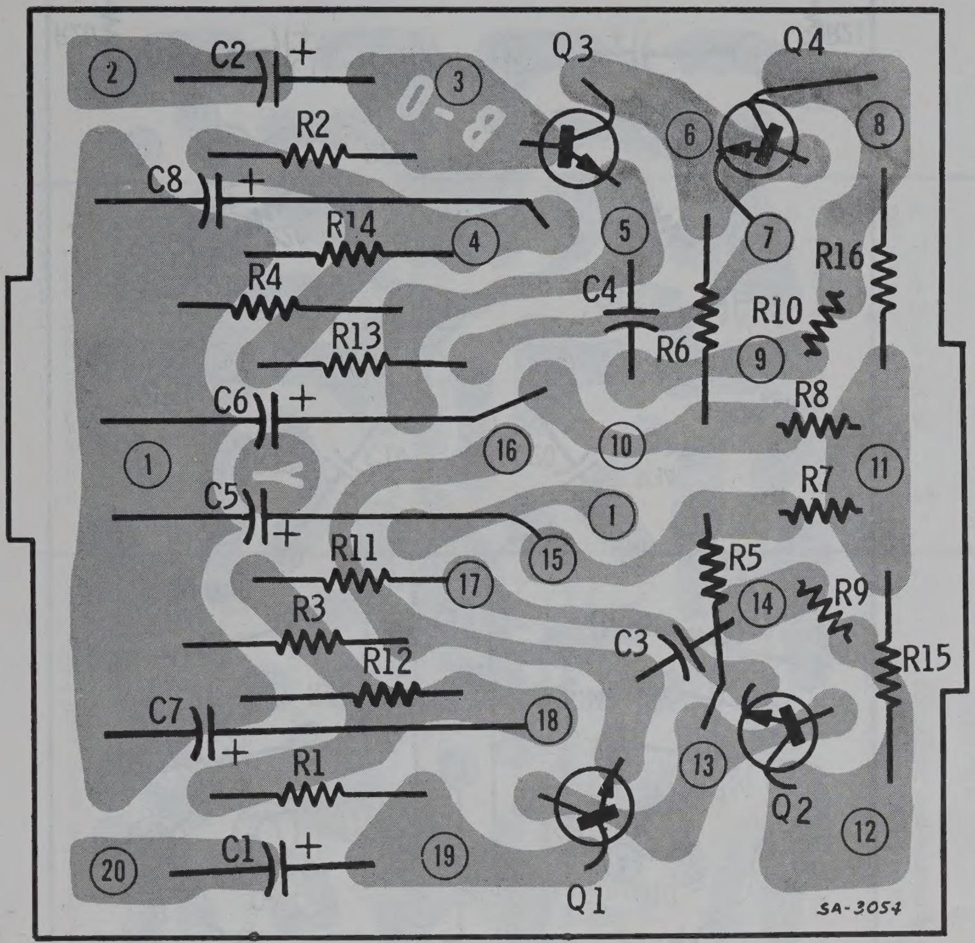
CAUTION
"A" LEAD MUST BE CONNECTED TO POSITIVE (+) SIDE OF POWER SUPPLY. RADIO WILL NOT OPERATE AND DAMAGE TO COMPONENTS WILL RESULT IF CONNECTED OTHERWISE.

NOTES:

CAPACITORS - UNLESS OTHERWISE SPECIFIED DECIMAL VALUES IN MF. ALL OTHERS IN PF. VOLTAGES - MEASURED FROM POINT INDICATED TO CHASSIS WITH A VTVM. + 10% NO SIGNAL INPUT.

* RESISTOR VALUE IS DETERMINED BY TRANSISTOR COLOR CODE, REPLACE WITH SAME VALUE AS ORIGINALLY IN SET.

SCHEMATIC DIAGRAM


C2
Q3
Q4
R2
C8
R14
R4
R13
C6
C5
R11
R3
R12
C7
R1
C1
C4
R6
R16
R10
R8
R7
R5
R9
C3
R15
Q1
Q2
1
2
3
4
5
6
7
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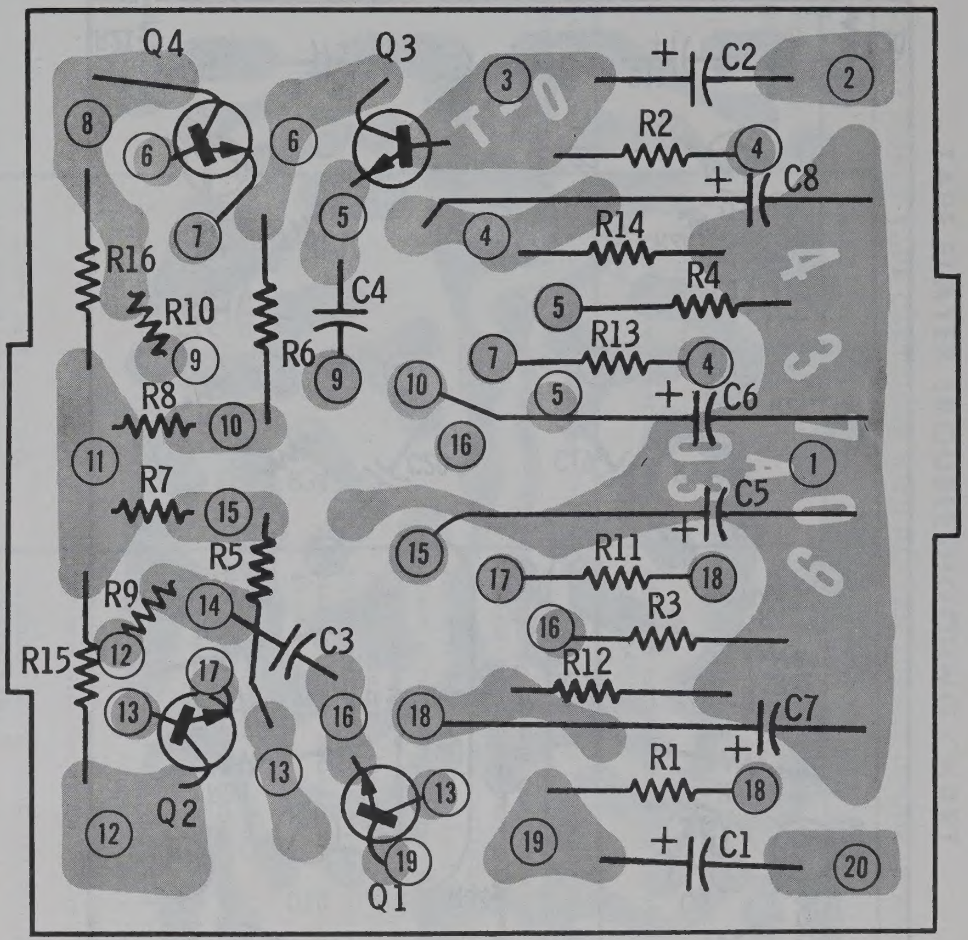
SA-3054

TAPE PRE-AMP - BOTTOM VIEW

PLATED CHASSIS REFERENCE POINTS AND PARTS LOCATION

(VIEW FROM WIRING SIDE OF BOARD)


Q4
Q3
C2
R2
C8
R14
R4
R13
C6
C5
R11
R3
R12
C7
R1
C1
R16
R10
C4
R6
R8
R7
R5
R9
R15
C3
Q2
Q1
1
2
3
4
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7
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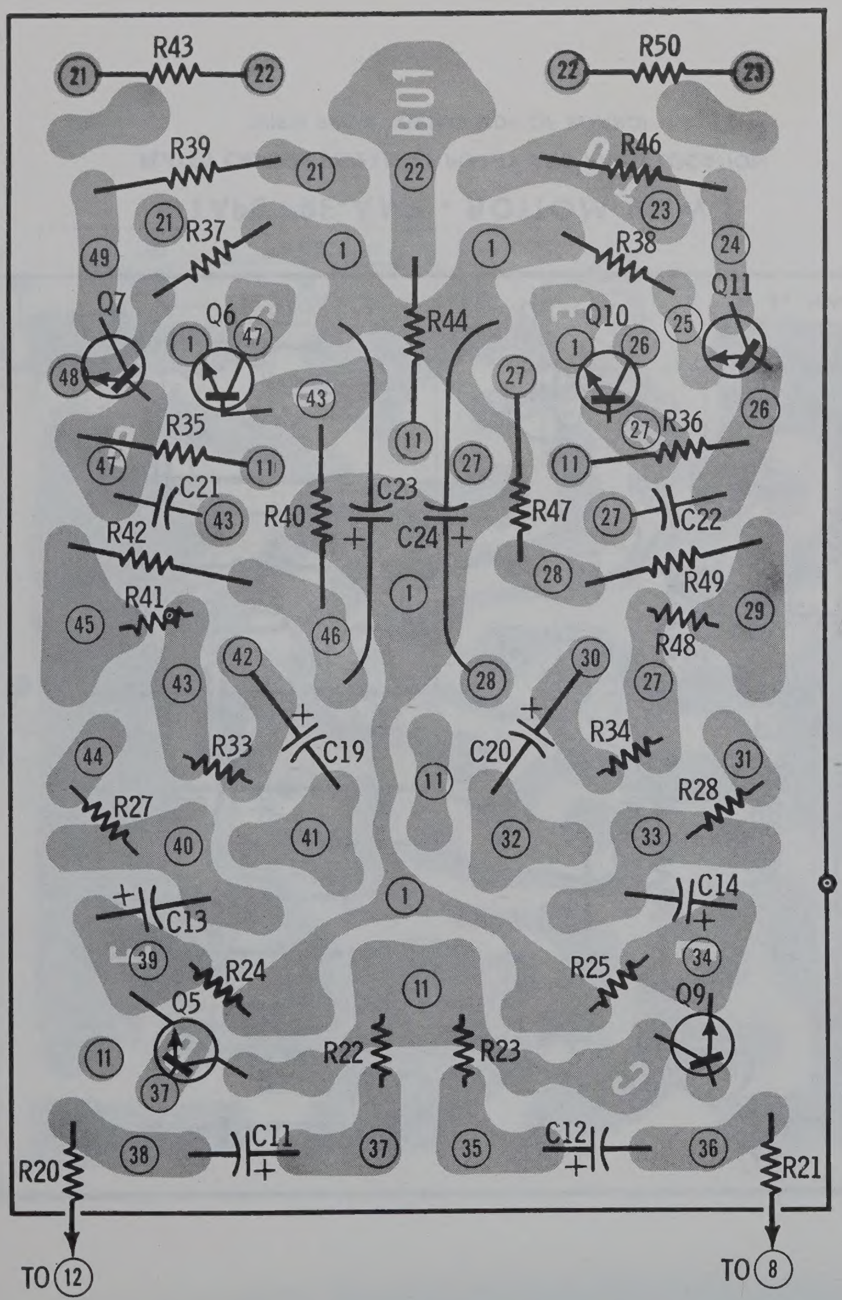
TAPE PRE-AMP - TOP VIEW

PLATED CHASSIS REFERENCE POINTS AND PARTS LOCATION

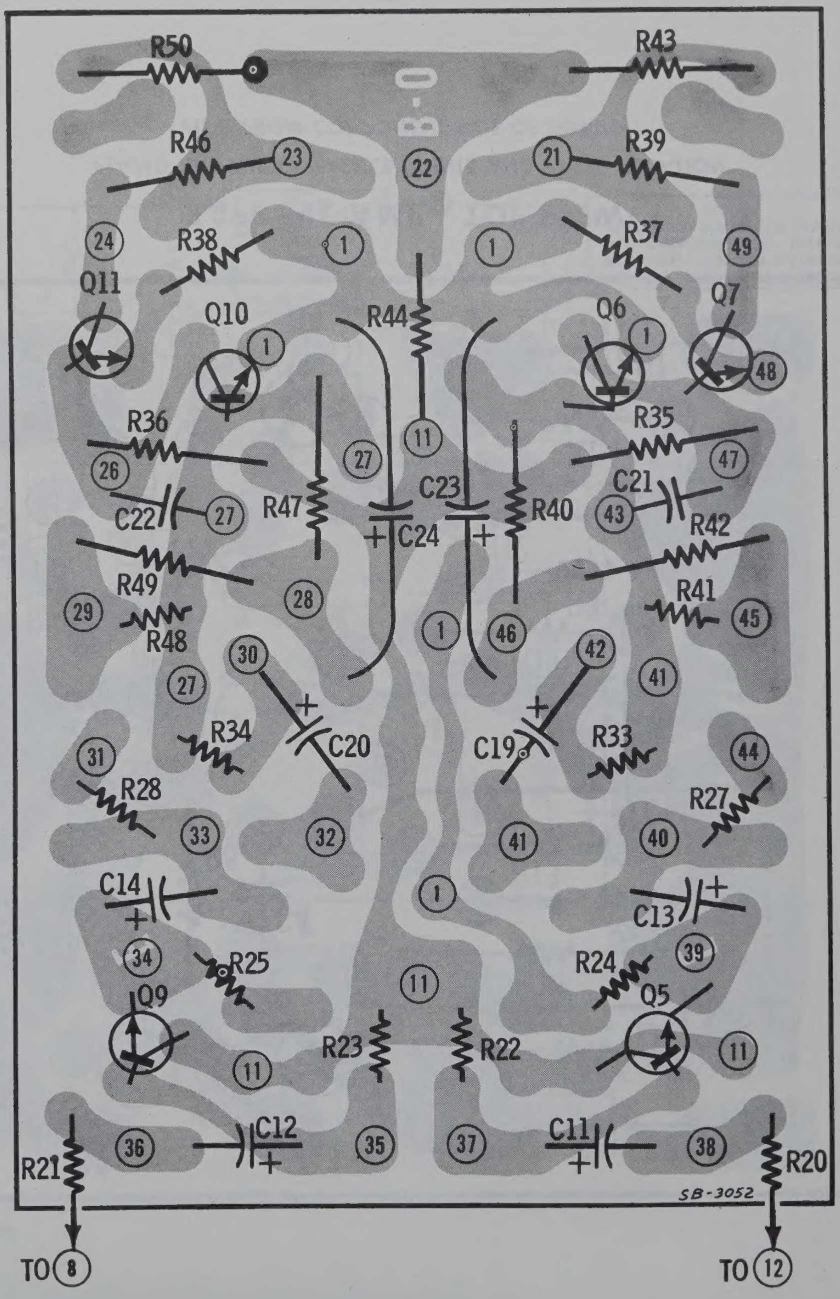
(VIEW FROM COMPONENT SIDE OF BOARD)


R43
R50
B01
R39
R46
R37
R38
Q7
Q6
R44
Q10
Q11
R35
R36
C21
C23
C24
R40
R47
C22
R42
R49
R41
R48
C19
C20
R33
R34
R27
R28
C13
C14
R24
R25
Q5
Q9
R22
R23
C11
C12
R20
R21
TO 12
TO 8

AUDIO AMPLIFIER - TOP VIEW

PLATED CHASSIS REFERENCE POINTS AND PARTS LOCATION

(VIEW FROM COMPONENT SIDE OF BOARD)


R50
R43
B-0
R46
R39
R38
R37
Q11
Q10
R44
Q6
Q7
R36
R35
C22
R47
C23
C24
R40
C21
R42
R49
R48
R41
C20
C19
R34
R33
R28
R27
C14
C13
R25
R24
Q9
Q5
R23
R22
C12
C11
R21
R20
SB-3052
TO 8
TO 12

AUDIO AMPLIFIER - BOTTOM VIEW

PLATED CHASSIS REFERENCE POINTS AND PARTS LOCATION

(VIEW FROM WIRING SIDE OF BOARD)

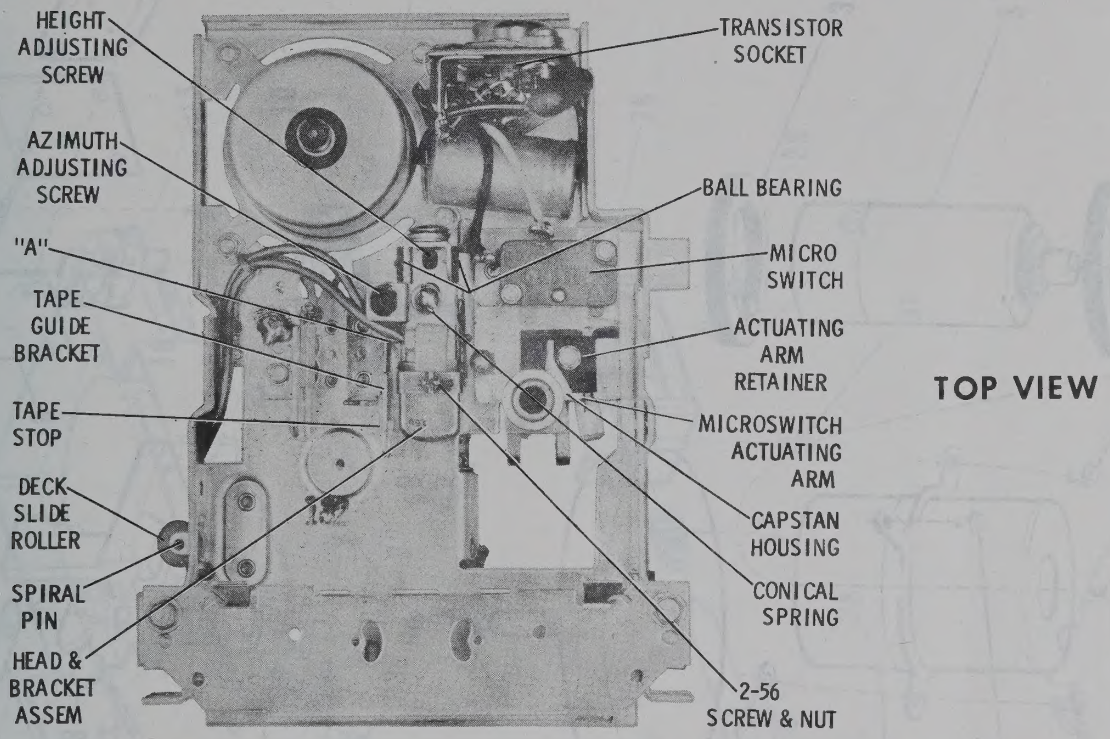
TAPE PLAYER TROUBLESHOOTING CHART

CAUTION: DO NOT INSERT TAPE CARTRIDGE WITH PLAYER TURNED UPSIDE DOWN.

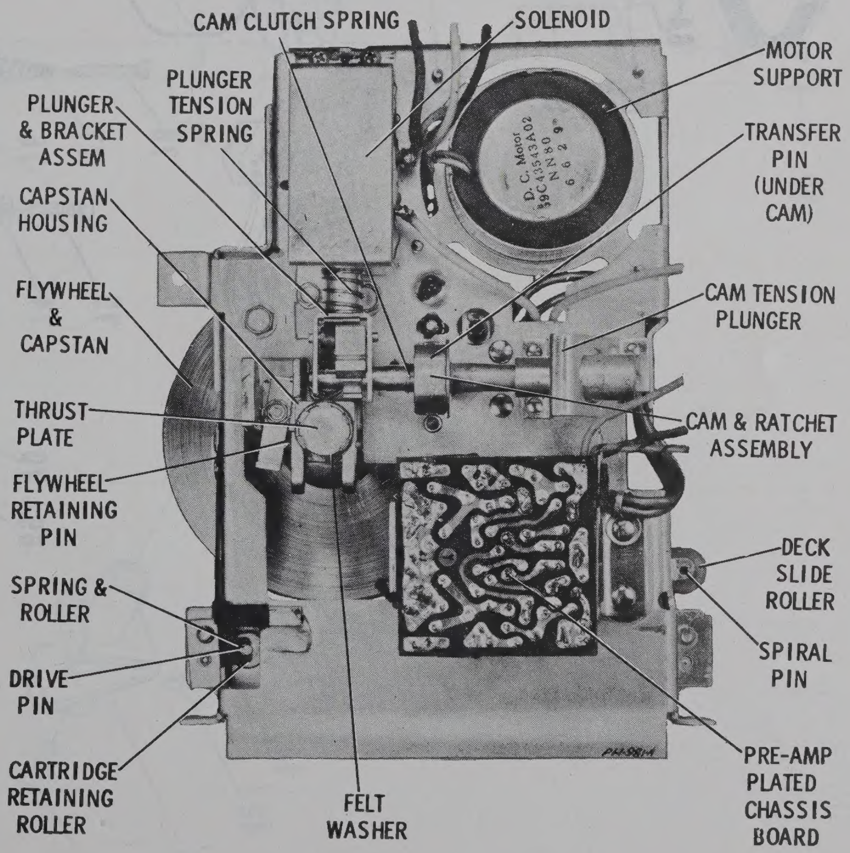
SYMPTOM	CAUSE	POSSIBLE SOLUTION
Tape breaks or winds up around capstan shaft.	1. Defective tape cartridge.	Check tape cartridge by inserting a known good tape cartridge. CAUTION: Make sure all tape wound around capstan shaft is removed.
	2. Bent micro-switch actuating arm.	Check and straighten or replace.
	3. Defective capstan housing.	Replace capstan housing (Motorola Part Number 15P40059A28).
Poor tape drive (also wow and flutter).	1. Insufficient tension on tape cartridge.	Check cartridge tension by pulling cartridge slightly away from tape head, then release; the cartridge should snap back into place and there should be no end play on the right side of the cartridge. If the cartridge does not snap in or there is end play, replace the spring and roller. Make sure mounting screw does not protrude too far to interfere with cartridge. Also, with cartridge inserted, the roller on the left side should be in contact with the cartridge. If it isn't, replace the roller (Motorola Part Number 49A43659A03.
	2. Flywheel and/or motor drive shaft dirty or greasy.	Use isopropyl (rubbing) alcohol to clean the following areas: outer edge of flywheel, motor drive shaft and capstan shaft.
	3. Drive belt improperly installed.	Make certain rough surface of drive belt is on inside; that is, rough surface drives motor shaft and flywheel. On belts having a stripe, install the belt with the stripe on the outside.
	4. Drive belt defective (stretched, etc.).	Replace drive belt (Motorola Part Number 42B43871A01).
Cross-talk	1. Defective tape cartridge.	Check tape cartridge by substitution with a known good tape cartridge.
	2. Tape head out of adjustment.	Check head height and azimuth adjustments with a test tape (Motorola Part No. 99P43309A01) as outlined in "Adjustment" section.
	3. Head mounting bracket binding.	Grasp at rear of head mounting bracket with a pair of long nose pliers and squeeze gently while moving head up and down until binding is relieved. (CAUTION: Do not apply excessive pressure as ball bearings may pop out.) To check this adjustment, index tape head to its lower position (tracks #4 and #8), then with unit vertical, lift up tape head; it should have sufficient tension to spring back against the transfer pin without binding. Also check for 1/4" adjustment of head tension adjusting screw (see "Adjustments").
	4. Tape guide bracket not positioning tape correctly with respect to tape head.	Check distance between bottom edge of tape guide bracket and chassis; it should be .090" - .095". If it is not, bend or replace the tape guide bracket. CAUTION: Bend at point "A" not at the two (2) tines (see photo).
	5. Thrust plate on bottom of capstan housing loose or missing.	Replace capstan housing (Motorola Part Number 15P40059A28).
	6. Defective cam and shaft assembly.	Replace cam and ratchet assembly (Motorola Part Number 45B43929A01).
	7. Tape head not indexing correctly.	See "Improper Head Indexing".

SYMPTOM	CAUSE	POSSIBLE SOLUTION
Squeaking or excessive wow.	1. Thrust plate loose or missing from bottom of capstan housing or defective bearings in capstan housing.	Replace capstan housing (Motorola Part Number 15P40059A28). Do not attempt to lubricate oilite bearings.
Drive belt slips off flywheel (also slow tape start up).	1. Defective drive belt. 2. Motor drive shaft not vertical.	Replace drive belt (Motorola Part Number 42B43871A01). Examine drive belt action as follows: If belt tends to go up, bend the motor housing slightly away from the capstan shaft using wide jawed pliers. CAUTION: Do not apply any pressure to the brass pulley.
Tape pulls out of center of tape cartridge when cartridge is removed from unit.	1. Undersized or burred tape guide slot.	Use fine emery cloth to remove burrs or enlarge tape guide slot. Use extreme caution when enlarging slot. Excessive slot width can cause cross-talk.
Tape motor does not run when tape cartridge is inserted.	1. Micro-switch not actuated. 2. Defect in regulator circuitry.	Bend micro-switch actuating arm far enough to actutate micro-switch when tape cartridge is inserted. Check regulator circuitry.
Intermittent audio during tape operation.	1. Intermittent head connecting cable.	Definitely determine if the cable is at fault by wiggling the receptacle end of the cable or by feeding a signal at the input of the tape pre-amp (2 and 20 on schematic - refer to plated chassis reference points on schematic). If cable is at fault, replace (Motorola Part Number 30C40643B02).
Improper head indexing.	1. Inadequate tension on solenoid plunger tension spring. 2. Defective solenoid plunger. 3. Head tension screw out of adjustment. 4. Cam clutch spring out of hole or missing. 5. Defective cam and shaft assembly.	Increase tension on spring or replace. Replace solenoid plunger. Set the height of the screw so that there is 1/4" between the bottom flat portion of the screw head and the head bracket (see "Head Adjustment Locations" detail). See "Cross-talk", Possible Solution #2. Insert spring into its hole or replace cam if spring is missing. Replace cam.
Motor noise from tape motor.	1. Open motor filter capacitor (C-35).	Replace capacitor.
Unit does not change channels when channel selector is depressed.	1. Tape head not indexing properly. 2. Defective channel switch or solenoid.	See "Improper Head Indexing". Replace.
Slow speed (also see "Poor Tape Drive").	1. Mechanical binding.	Check for binding by first removing tape cartridge, turn on motor with micro-switch actuating arm and check flywheel speed with a strobe disc (Motorola Part No. 68P40059A33 or equivalent). If speed is excessively slow, shut off unit and remove drive belt; flywheel should move freely when turned by hand. If it does not, check for missing nylon bearing on bottom of flywheel, loose or missing thrust plate at bottom of capstan housing, defective bearings in capstan housing or defective flywheel.

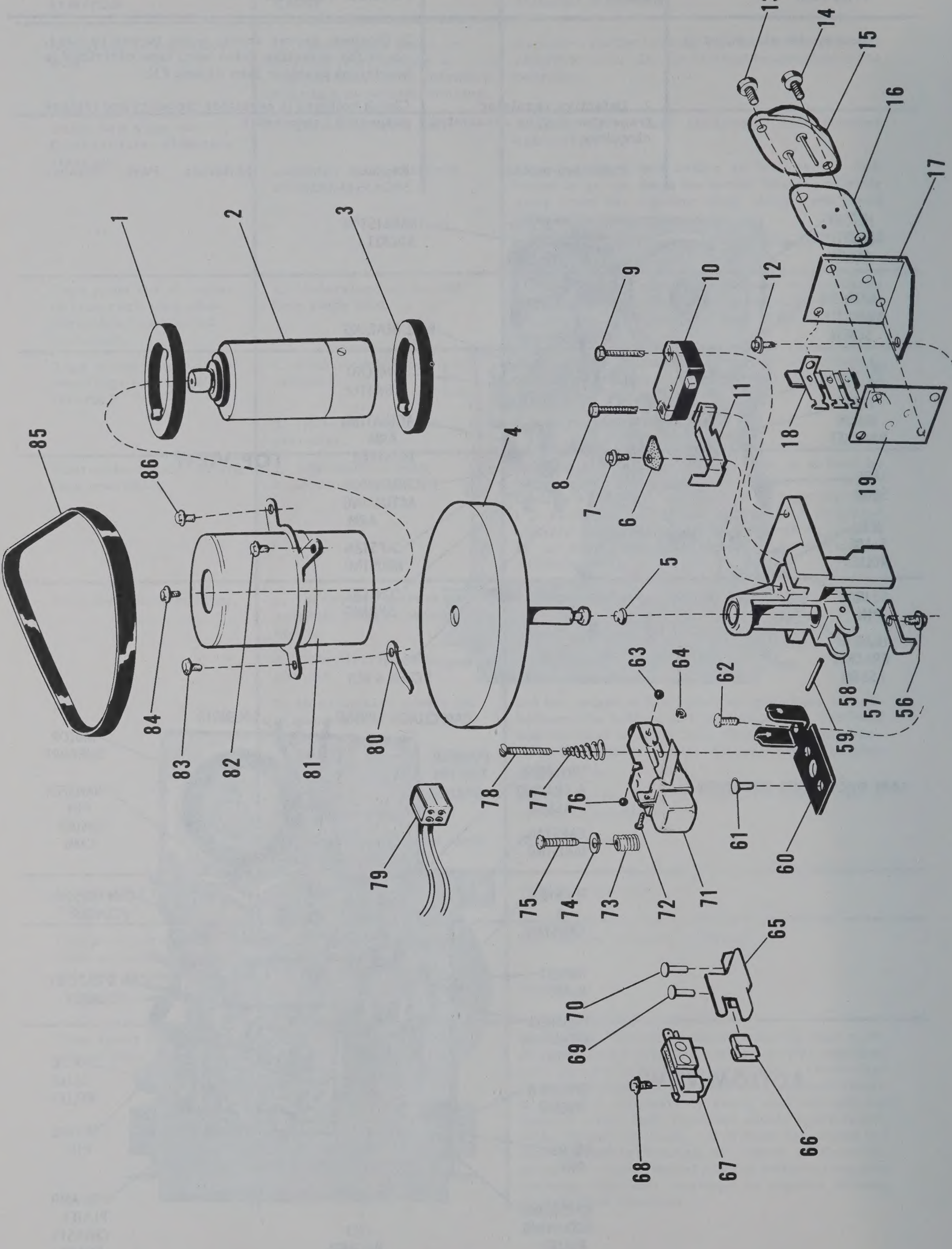
SYMPTOM	CAUSE	POSSIBLE SOLUTION
Slow speed, etc. (Cont'd)		If flywheel moves freely when turned by hand, check for defective drive belt, tape cartridge or electrical problem (see #2 and #3).
	2. Defective regulator transistor and/or associated circuitry.	Check voltages in regulator circuitry and replace suspected components.
	3. Defective motor.	Replace motor (Motorola Part Number 59C43543A02).

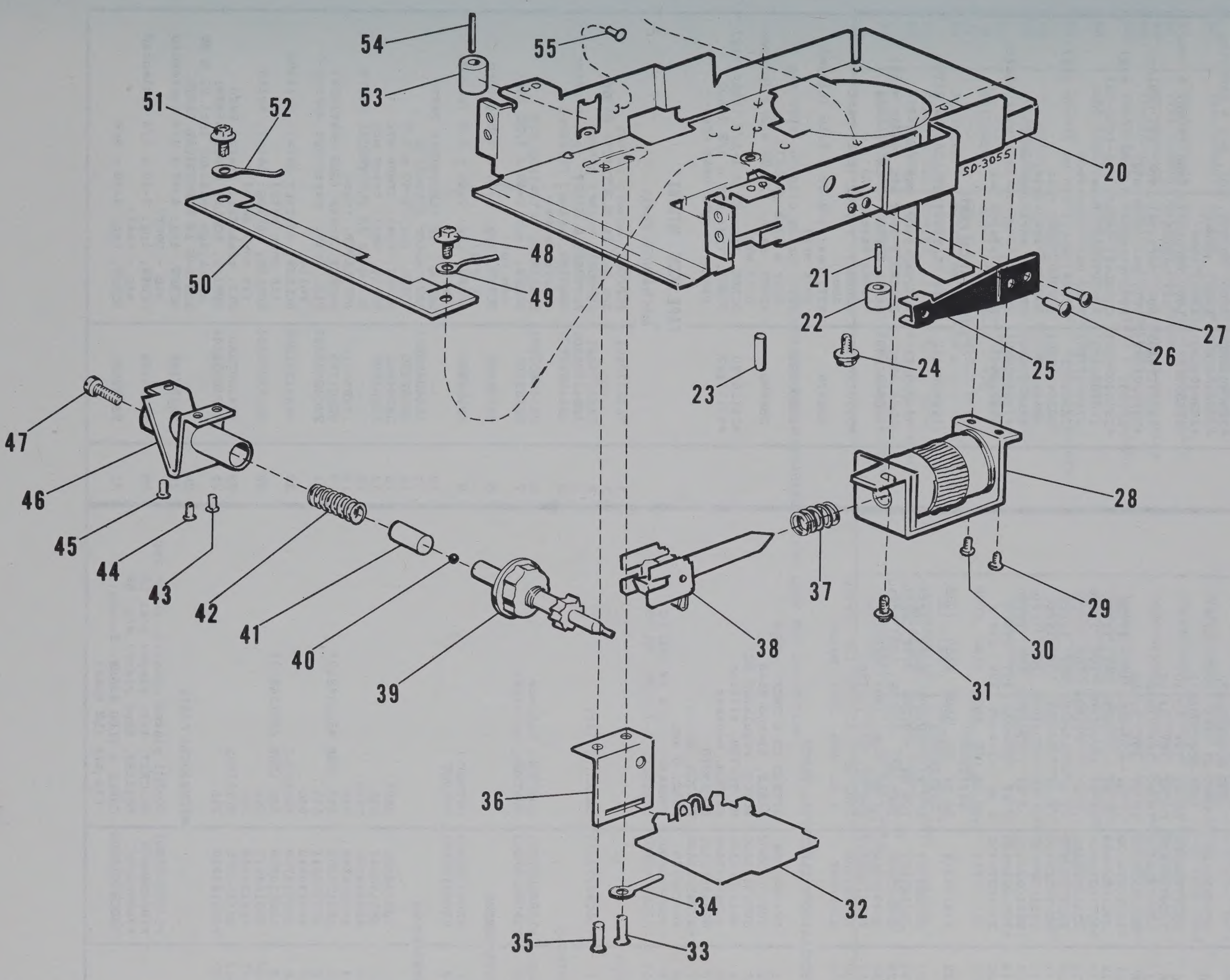

HEIGHT ADJUSTING SCREW
AZIMUTH ADJUSTING SCREW
"A"
TAPE GUIDE BRACKET
TAPE STOP
DECK SLIDE ROLLER
SPIRAL PIN
HEAD & BRACKET ASSEM
TRANSISTOR SOCKET
BALL BEARING
MICRO SWITCH
ACTUATING ARM RETAINER
MICROSWITCH ACTUATING ARM
CAPSTAN HOUSING
CONICAL SPRING
2-56 SCREW & NUT
TOP VIEW

TAPE DECK PARTS LOCATION


CAM CLUTCH SPRING
SOLENOID
MOTOR SUPPORT
PLUNGER & BRACKET ASSEM
PLUNGER TENSION SPRING
CAPSTAN HOUSING
FLYWHEEL & CAPSTAN
THRUST PLATE
FLYWHEEL RETAINING PIN
SPRING & ROLLER
DRIVE PIN
CARTRIDGE RETAINING ROLLER
FELT WASHER
TRANSFER PIN (UNDER CAM)
CAM TENSION PLUNGER
CAM & RATCHET ASSEMBLY
DECK SLIDE ROLLER
SPIRAL PIN
PRE-AMP PLATED CHASSIS BOARD
D. C. Motor
59C43543A02
NN80
6 6 2 9

BOTTOM VIEW




54
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SD-3055
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33

EXPLODED VIEW OF TAPE DECK PARTS

REPLACEMENT PARTS LIST

Ref. No.	Part Number	Description
		ELECTRICAL PARTS
CAPACITORS - NOTE:		The capacitors in this list are recommended replacement types for the original equipment; all are ceramic disc types unless otherwise specified.
C-1	23C41928A24	20 mf 16V lytic
C-2	23C41928A24	20 mf 16V lytic
C-3	8C42750A20	.0047 mf 10% 100V mylar (USE 8C40906A27)
C-4	8C42750A20	.0047 mf 10% 100V mylar (USE 8C40906A27)
C-5	23C41928A23	80 mf 16V lytic
C-6	23C41928A23	80 mf 16V lytic
C-7	23C41928A06	16 mf 16V lytic
C-8	23C41928A06	16 mf 16V lytic
C-11	*23C10229A09	.1 mf -20+40% 15V lytic
C-12	23C10229A09	.1 mf -20+40% 15V lytic
C-13	*23S10229A02	.3 mf -20+100% 10V lytic
C-14	23S10229A02	.3 mf -20+100% 10V lytic
C-15	23C10229A09	.1 mf -20+40% 15V lytic
C-16	23C10229A09	.1 mf -20+40% 15V lytic
C-17	23S10229A02	.3 mf -20+100% 10V lytic
C-18	23S10229A02	.3 mf -20+100% 10V lytic
C-19	*23S10229A03	2 mf -20+40% 10V lytic
C-20	23S10229A03	2 mf -20+40% 10V lytic
C-21	21S131917	56 pf 5% 500V N150 (USE 21R128699)
C-22	21S131917	56 pf 5% 500V N150 (USE 21R128699)
C-23	23S187A07	100 mf -10+50% 6.4V lytic
C-24	23S187A07	100 mf -10+50% 6.4V lytic
C-25	23S187A06	1000 mf -10+50% 16V lytic
C-26	8C40906A05	.1 mf 20% 100V mylar
C-27	23C41928A19	500 mf 16V lytic
C-30	23S187A06	1000 mf -10+50% 16V lytic
C-34	8S128692	.1 mf 20% 200V mylar
MISCELLANEOUS ELECTRICAL PARTS		
E-1	1V40800B98	STEREO HD & BRCKT ASSEM
E-2	30C40643B02	CABLE, stereo head
E-3	59C43543A02	MOTOR, regulated DC
E-4	48A41508A01	RECTIFIER, silicon
E-5	40B43642A01	SWITCH, contact
E-6	80B43685A01	SOLENOID
E-7	*40B43643A01	SWITCH, micro
E-8	65R122345	FUSE, 5 amp
E-9	*50B64060B01	SPEAKER, 5-1/4 PM: 8Ω VC
E-10	50B64060B01	SPEAKER, 5-1/4 PM: 8Ω VC
CHOKE		
L-1	*25C64172A15	CHOKE, filter
CONTROLS		
R-26	*18B64051B01	CONTROL, balance
R-31	*18D64047B01	CONTROL, multiple
TRANSFORMERS		
T-1	25D64129A01	OUTPUT
T-2	25D64129A01	OUTPUT
TRANSISTORS		
Q-1	48S134823	M822
Q-2	48S134846	54E
Q-3	48S134823	M822
Q-4	48S134846	54E
Q-5	48S134809	54B (USE 48S134810)
Q-6	48S134811	54D
Q-7	48S134810	54C
Q-8	48S134759	SP1556-2
Q-9	48S134809	54B (USE 48S134810)
Q-10	48S134811	54D
Q-11	48S134810	54C
Q-12	48S134759	SP1556-2
Q-13	*48S134930	P1E
		MECHANICAL PARTS
	*84C64052B01	BOARD, plated chassis: audio amp
	*7B64048B02	BRACKET, tape player mtg: LH
	*7B64048B01	BRACKET, tape player mtg: RH
	*30C64013B04	CABLE & PLUG ASSEM: 2-conn; blu-blk (LH spkr)
	*30C64013B03	CABLE & PLUG ASSEM: 2-conn; red-blk (RH spkr)
	*15C64039B01	COVER, back: heat sink
	*15C64037B01	COVER, top & bottom
	15C60139B01	DOOR, tape cartridge
	*1V64966A10	ESCUTCHEON & CARTRIDGE DOOR ASSEM: incl overlay
	*13B64058B01	GRILLE, speaker
	*15D64057B01	HOUSING, speaker
	14A543810	INSULATOR, transistor
	*36B64042B01	KNOB, on-off, vol, bal & indexing
	*36B64041B02	KNOB, pendant
	*36B64041B01	KNOB, tone
	29K534326	LUG, terminal: fuse recept & spkr ext cables
	29A64778A02	LUG, terminal: spkr ext cables
	*2S10101A27	NUT, pal (spkr mtg)
	2S7051	NUT, stamped: 3/8-32 (cont mtg)
	*13C64036B01	OVERLAY, escut: vol-tone-bal
	1V64964A32	RECEPTACLE, fuse: incl fuse
	47A60177B01	ROD, cartridge door
	3K560695	SCREW, spcl: clu hd (trans mtg)
	*26B64115B01	SHIELD, spkr rain
	9B542339	SOCKET, transistor
	41A60175B01	SPRING, cartridge door
	*41A64056B01	SPRING, compression: cont shafts
	42K544845	STRAP, player mtg
		INSTALLATION PARTS
	*1V64966A12	TAPE PLAYER INSTALLATION KIT
	45K538873	ARM, adaptor: pwr lead
	*7B64059B01	BRACKET, spkr mtg (under dash)
	*30C64063B01	CABLE & PLUG ASSEM: 2-conn (spkr extension)
	*5S10115A10	GROMMET, rubber (spkr cable - door)
	2S2878	NUT, hex: 1/4-20 x 7/16 (player brkt mtg)
	*2S10054A34	NUT, spring clip-on (spkr mtg - door & kick panel)
	3S6990	SCREW, mach: 1/4-20 x 3/4 (player brkt mtg)
	*3S135780	SCREW, tpg: #8 x 1-1/4 (spkr mtg)
	*3S135147	SCREW, tpg: #10 x 1/2 (tape player & spkr brkt mtg)
		TAPE DECK - MTD101
		MECHANICAL PARTS
1	7A43576A01	SUPPORT, motor: rubber
2	---	SEE E-3 IN ELECTRICAL PARTS
3	7A43576A01	SUPPORT, motor: rubber
4	49B43791A01	FLYWHEEL & SHAFT: incl bearing
5	43A43867A01	BEARING, nylon: flywheel & shaft assem
6	26A40607B01	RETAINER, actuating arm
7	3S132645	SCREW, tpg: 4-40 x 7/32 (act arm ret)
8	3S122820	SCREW, tpg: 4-40 x 5/8 (micro sw mtg)
9	3S122820	SCREW, tpg: 4-40 x 5/8 (micro sw mtg)
10	---	SEE E-7 IN ELECTRICAL PARTS
11	45B40480B01	ARM, motor actuating
12	3S132220	SCREW, tpg: 4-40 x 5/8
13	3K564805	SCREW, spcl: trans mtg
14	3K564805	SCREW, spcl: trans mtg
15	---	SEE Q-13 IN ELECTRICAL PARTS
16	14A543810	INSULATOR, trans
19	9K561755	SOCKET, trans (USE 9B542339)
21	22C42038A05	PIN, drive: cartridge spring & roller
22	49A41281B01	ROLLER, spring: metal; drilled (in some sets)
22	49A43658A01	ROLLER, spring: metal; solid (in some sets)
23	22A43573A01	PIN, transfer: stereo head
25	41P40059A48	SPRING, ROLLER & PIN ASSEM: cartridge tension: incl 21 & 22
28	---	SEE E-6 IN ELECTRICAL PARTS
29	3S132188	SCREW, tpg: 4-40 x 1/4 (solenoid mtg - rear)
30	3S132188	SCREW, tpg: 4-40 x 1/4 (solenoid mtg - rear)
31	3S132220	SCREW, tpg: 4-40 x 5/8

Ref. No.	Part Number	Description
32	84D43709A03	BOARD, plated: pre-amp; less all comp
37	41A43742A01	SPRING, plunger return
38	47P40059A24	PLUNGER, BRACKET & ACTUATOR ASSEM
39	45B43929A01	CAM & RATCHET ASSEM
40	43K471633	BEARING, ball: 3/32 (cam plunger & tape head)
41	47A40181B01	PLUNGER, cam tension
42	41A40180B01	SPRING, azimuth & cam tension
53	49A43659A03	ROLLER, deck slide: plastic (blk code - in some sets)
53	49A43659A01	ROLLER, deck slide: plastic (in some sets)
54	22B43667A03	PIN, spirol: deck slide roller
58	15P40059A28	CAPSTAN HSG ASSEM
59	22C42038A02	PIN, drive: flywheel retaining
60	41B43609A01	SPRING, head bracket mtg
62	3T43787A01	SCREW, spcl: 4-40 x 1/4 (height adjust)
63	43K471633	BEARING, ball: 3/32 (cam plunger & tape head)
64	2S7041	NUT, hex: 2-56 x 3/16 (to secure stereo head)
65	7B43531A01	BRACKET, tape guide
66	46B40913B01	STOP, tape: nylon (tape guide brkt)
67	---	SEE E-5 IN ELECTRICAL PARTS
68	3S132220	SCREW, tpg: 4-40 x 5/8
71	---	SEE E-1 IN ELECTRICAL PARTS
72	3S135441	SCREW, mach: 2-56 x 1/4 (stereo hd)
73	41A40180B01	SPRING, azimuth & cam tension
75	3T43787A02	SCREW, spcl: 4-40 x 5/8 (azimuth adjust)
76	43K471633	BEARING, ball: 3/32 (cam plunger & tape head)

Ref. No.	Part Number	Description
77	41A43778A01	SPRING, conical: hd adjust screw
78	3S6961	SCREW, mach: 4-40 x 3/4 (head tension adjust)
79	---	SEE E-2 IN ELECTRICAL PARTS
81	26B43657A01	SHIELD, motor mtg
85	42B43871A01	BELT, drive

KM13S REPLACEMENT PARTS

Ref. No.	Part Number	Description
	30C64013B06	CABLE & PLUG ASSEM: 2-conn: blk recept lead - blu plug lead: 10"
	30C64013B05	CABLE & PLUG ASSEM: 2-conn: blk recept lead - red plug lead: 10"
	30C64013B08	CABLE & PLUG ASSEM: 2-conn: blu recept lead - blk plug lead: 10"
	30C64013B07	CABLE & PLUG ASSEM: 2-conn: red recept lead - blk plug lead: 10"
	18B64159B01	CONTROL, fader
	*32B64169B01	GASKET, speaker
	13B64058B01	GRILLE, speaker
	15D64057B01	HOUSING, spkr
	29A64778A02	LUG, term: brn spkr lead
	29K534326	LUG, term: brn/wht spkr lead
	2S10101A27	NUT, spring: spkr mtg
	26B64115B01	SHIELD, spkr
	50D64060B01	SPEAKER, 5-1/4 PM

INSTALLATION PARTS

Ref. No.	Part Number	Description
	5S10115A10	GROMMET, rubber
	*1V64950A34	INSTALLATION KIT: complete
	36B543382	KNOB, fader
	2S1376	NUT, hex: 3/8-32 (cont mtg)
	2S10054A34	NUT, spring: spkr
	3S135780	SCREW, tpg: #8 x 1-1/4

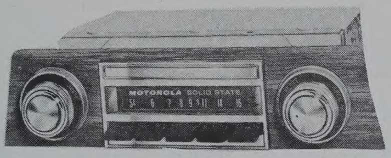
*DENOTES NEW ITEM APPEARING IN ANY LIST FOR FIRST TIME.

auto radio **MANUAL 68P64994A63**

MODELS OE67A, PC67A, TM17A

MOTOROLA

service manual



MODEL OE67A

MODEL PC67A

MODEL TM17A

GENERAL INFORMATION

Automotive type all-transistor superheterodyne AM radios for standard broadcast reception; these receivers operate from 12 volt negative ground systems. Designed for custom installation in the following cars:

Model OE67A - 1967 Oldsmobile (Dynamic 88, Etc.).

Model PC67A - 1967 Pontiac (Catalina, Etc.).

Model TM17A - Universal type capable of installation in many vehicles (cars, trucks, boats, etc.) by using the AK-223, AK-230 or KM35T trimplate kits. The control shaft spacing can be adjusted to match the hole spacing in the dash panel (see "Radio Installation Detail").

This model also contains the Lumalert feature; an automatic device that produces an audible indication through the radio speaker that the parking or headlights have been left on. The Lumalert circuitry is basically a transistorized audio oscillator activated by the light switch circuitry.

These receivers contain 6 transistors (7 in Model TM17A) and 2 diodes and use 40 ohm speaker systems.

SERVICE NOTES

1. Make certain the "A" lead is connected to the positive (+) side of the power source, otherwise, damage to receiver may result. If a battery eliminator is used as a power source in place of a battery, it must be well filtered and regulated.

2. When replacing a power output transistor, remember to use the transistor specified in the parts list; coat both sides of the transistor insulator with DC-4 grease (Motorola Part No. 11M490487) and securely tighten the transistor mounting screws. When replacing all other transistors, use long-nose pliers as a heat sink, i.e., grasp transistor leads close to transistor base with the pliers to dissipate heat while soldering.

3. The plated chassis used in these receivers have plating on both sides; the exposed side (opposite components) contains the actual circuitry while the plating on the component side contains primarily B- points.

Servicing techniques applicable to these models can be found in the following Motorola publications: "Profitable Transistor Radio Servicing" (Motorola Part Number 68P60011A53) and "A Discussion Of Transistorized Car Radios" (Motorola Part No. 68P64980A51).

4. REAR SPEAKERS - Models OE67A and PC67A - The RS-9 (6" x 9" - 40 ohm), RS-10 (6" - 40 ohm) or RS-12 (6" x 9" - 40 ohm, large magnet) rear speaker kits can be used with these radios.

REAR SPEAKER - Model TM17A - The RS-8 (6" x 9" - 40 ohm with fader control) or RS-11 (6" x 9" - 40 ohm, large magnet with fader control) rear speaker kit can be used with this radio.

TO SET PUSHBUTTONS

Unlock pushbutton by pulling it out about 1/2" forward of its normal position. Tune in station and lock the pushbutton to the station by pushing it in firmly.

MOTOROLA AUTO RADIO WARRANTY SERVICE STATION PROCEDURE

1. A Motorola Branded Model is one that has the Motorola name and is distributed to dealers through the Motorola Distributor.

2. These models are guaranteed for all parts and labor, including removal and re-installation (R & R), for a period of two years from the date of purchase. The following repairs are not covered under this guarantee: the elemination of motor noise, tire static, electrical interference and faulty installation. Charges for these repairs are to be paid by the customer.

3. Before performing a guarantee repair on a Motorola Branded Auto Radio, you must first receive the Customer's Car Radio Guarantee and Service Booklet. The installation and model information on the booklet must be filled in by the selling dealer at the time of retail sale. The Customer's Car Radio Guarantee and Service Booklet must show that the radio is within the guarantee period to be repaired under the Motorola Auto Radio Guarantee.

4. To obtain your labor allowance for the servicing of the customers in-guarantee set, fill in the Motorola Guarantee Labor Claim, Part No. 68P60016A30. If you perform a R & R service, you are entitled to the R & R allowance. If you only repair the radio without R & R service, you are entitled to the labor allowance. However, if you perform both R & R and the repair, then be sure to indicate both on your claim form for both allowances. After the form has been filled in, mail the pink and green copies to your Motorola Distributor for payment. The yellow copy is to be retained in the Service Station file.

MOTOROLA INC. 9401 WEST GRAND AVENUE, FRANKLIN PARK, ILLINOIS

PART NO. 68P64994A63 2-67 PRICE 20 CENTS

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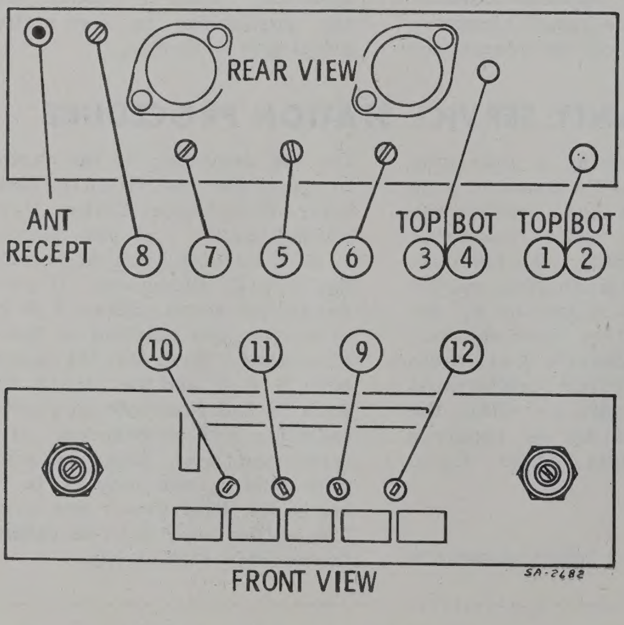
5. Defective parts for guarantee repairs made are to be sent to your Motorola Distributor for free replacement supported with the defective parts return tag, Part Number 54P591808.

6. Only those service stations authorized by their Motorola Distributor can perform repairs within the guarantee period on a no-charge basis to the customer. If you are not an Authorized Motorola Auto Radio Service Station and you are interested in handling this service, please contact your Motorola Distributor for complete details.

ALIGNMENT

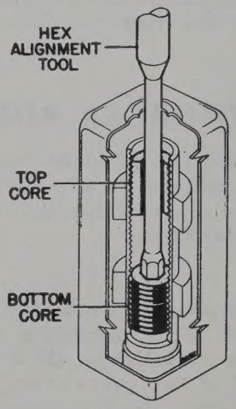
Connect an output meter across the speaker voice coil. Set volume to maximum and tone to treble. Attenuate signal generator output to maintain 1 watt (6.33 volts across a 40 ohm load) on output meter at all times.

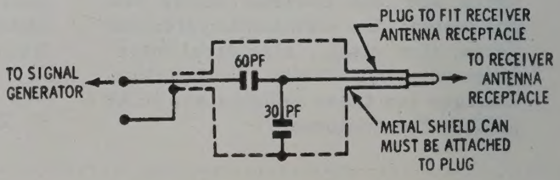
STEP	GENERATOR CONNECTION	GENERATOR FREQUENCY (400 cycle 30% mod)	TUNER SET TO	ADJUST	REMARKS
IF ALIGNMENT					
1.	To collector of RF amp thru .1mf and chassis	262.5Kc	Hi end stop	1, 2, 3 & 4	Adjust for maximum.
RF ALIGNMENT					
2.	Antenna receptacle thru dummy (see Figure)	1610Kc	Hi end stop	5, 6 & 7	Adjust for maximum.
NOTE:	Do not perform Steps #3, #4, #5 and #6 unless the tuner has been tampered with or associated components have been replaced. If necessary, remove the escutcheon, dial background and the pilot light socket to expose the core screws. Before proceeding with Step #3, back the tuning cores as far as possible out of the coils to eliminate their effect on trimmer adjustments.				
3.	Antenna receptacle thru dummy (see Figure)	1610Kc	Hi end stop	5, 6, 7 & 8	Adjust for maximum.
4.	"	1200Kc (pushbutton models)	Tuner carriage .285" from hi end stop	9, 10, 11 & 12	Adjust for maximum.
5.	"	1610Kc	Hi end stop	5, 6, 7 & 8	Adjust for maximum.
6.	Repeat Steps #4 and #5 until no further increase; Step #5 should be last step. Then cement core screws in place.				
ANTENNA TRIMMER					
7.	----	----	Weak station around 1400Kc	8	Adjust for maximum with car radio installed in car and antenna fully extended.


REAR VIEW
ANT RECEPT
8
7
5
6
TOP
BOT
3
4
TOP
BOT
1
2
10
11
9
12
FRONT VIEW
SA-2482

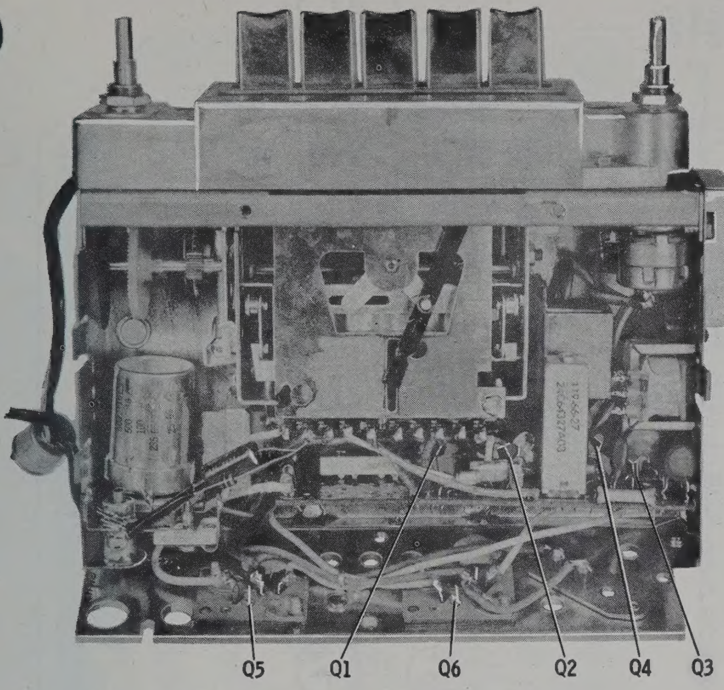
ALIGNMENT LOCATION DETAIL

IF ALIGNMENT DETAIL

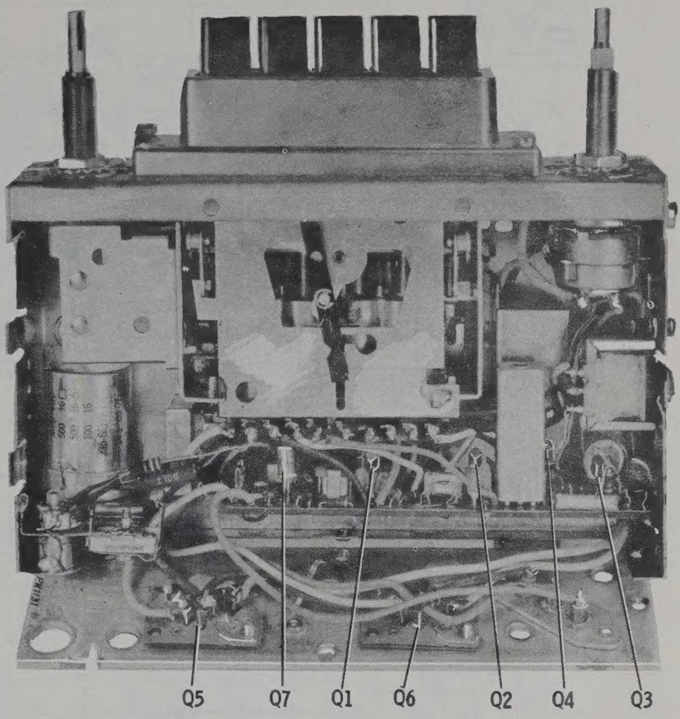

HEX ALIGNMENT TOOL
TOP CORE
BOTTOM CORE


PLUG TO FIT RECEIVER ANTENNA RECEPTACLE
TO SIGNAL GENERATOR
60PF
30PF
TO RECEIVER ANTENNA RECEPTACLE
METAL SHIELD CAN MUST BE ATTACHED TO PLUG

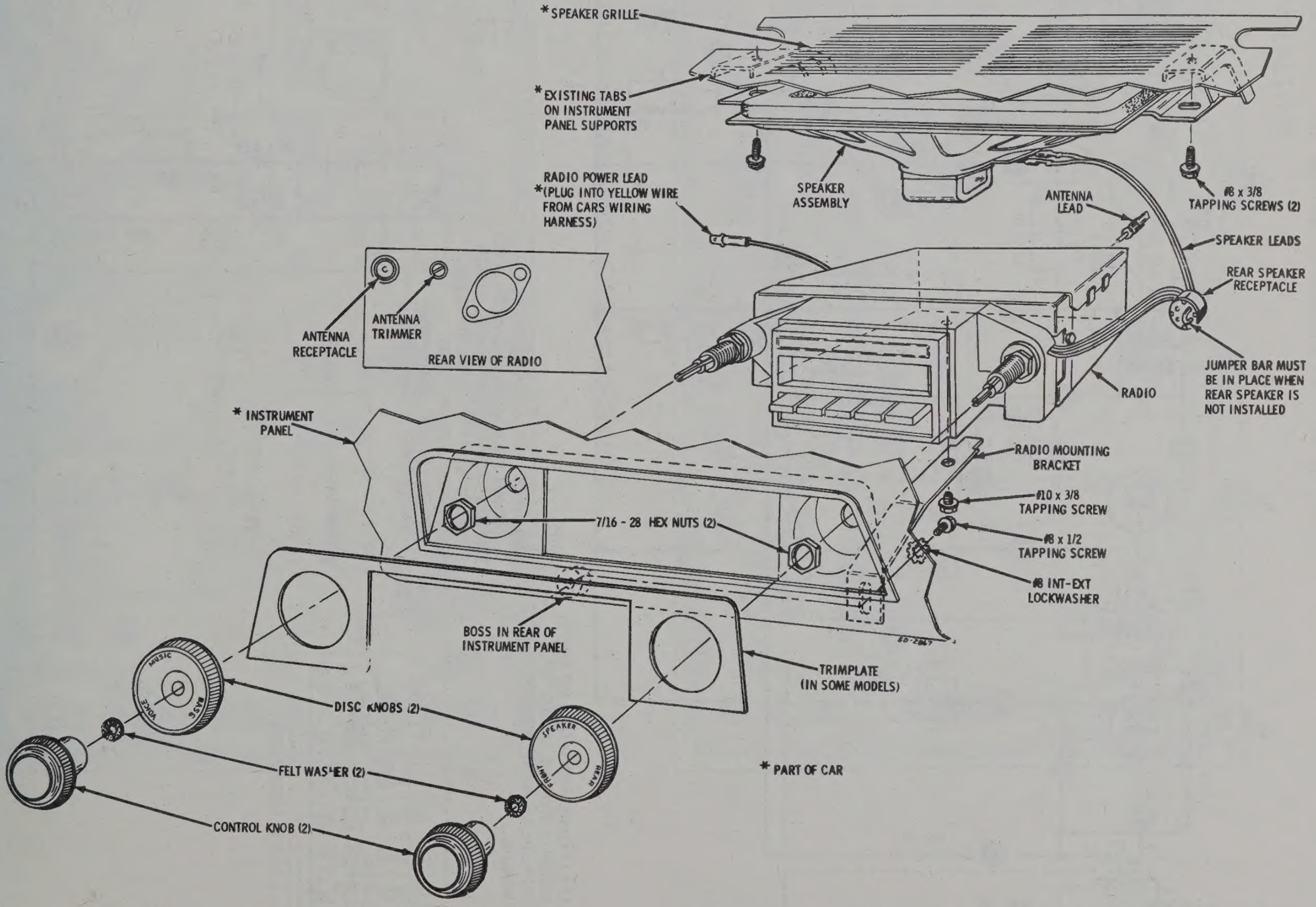
DUMMY ANTENNA DETAIL


Q5
Q1
Q6
Q2
Q4
Q3

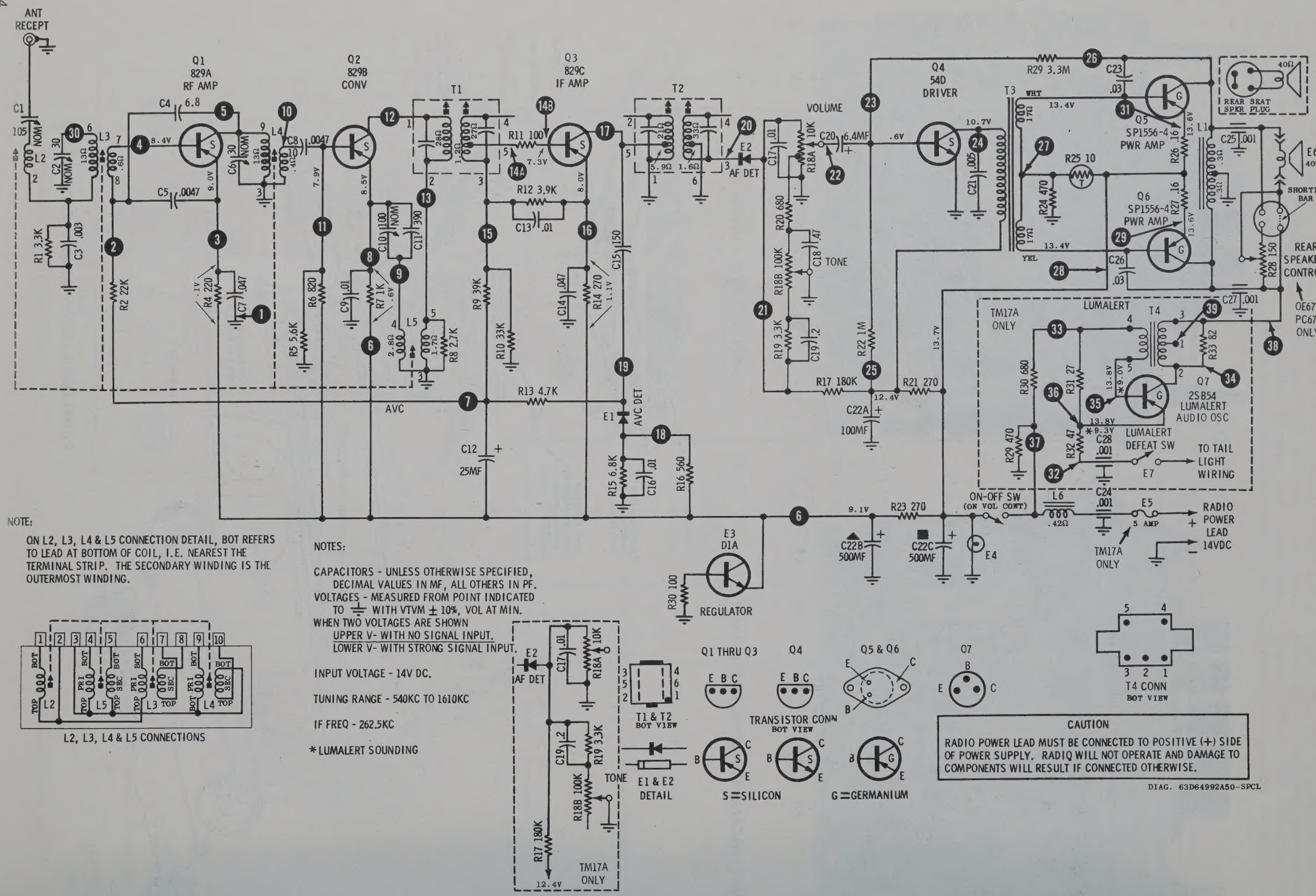
PARTS LOCATION - MODELS OE67A AND PC67A


Q5
Q7
Q1
Q6
Q2
Q4
Q3

PARTS LOCATION - MODEL TM17A


*SPEAKER GRILLE
*EXISTING TABS ON INSTRUMENT PANEL SUPPORTS
SPEAKER ASSEMBLY
#8 x 3/8 TAPPING SCREWS (2)
RADIO POWER LEAD *(PLUG INTO YELLOW WIRE FROM CARS WIRING HARNESS)
ANTENNA LEAD
SPEAKER LEADS
REAR SPEAKER RECEPTACLE
ANTENNA RECEPTACLE
ANTENNA TRIMMER
REAR VIEW OF RADIO
JUMPER BAR MUST BE IN PLACE WHEN REAR SPEAKER IS NOT INSTALLED
RADIO
* INSTRUMENT PANEL
RADIO MOUNTING BRACKET
#10 x 3/8 TAPPING SCREW
7/16 - 28 HEX NUTS (2)
#8 x 1/2 TAPPING SCREW
#8 INT-EXT LOCKWASHER
BOSS IN REAR OF INSTRUMENT PANEL
TRIMPLATE (IN SOME MODELS)
MUSIC
VOICE
BASS
DISC KNOBS (2)
SPEAKER
FRONT
REAR
FELT WASHER (2)
CONTROL KNOB (2)
* PART OF CAR

RADIO INSTALLATION DETAIL - MODEL OE67A


ANT RECEPT
C1 105
L2 NOM
C2 30 NOM
L3 13Ω .6Ω
R1 3.3K
C3 .003
R2 22K
Q1 829A RF AMP
C4 6.8
C5 .0047
R4 220
C7 .047
C6 30 NOM
L4 13Ω .4Ω
C8 .0047
R5 5.6K
R6 820
Q2 829B CONV
C9 .01
R7 1K
C10 100 NOM
C11 390
L5 2.8Ω 1.7Ω
R8 2.7K
T1
Q3 829C IF AMP
R11 100
R12 3.9K
C13 .01
R9 39K
R10 33K
C14 .047
R14 270
R13 4.7K
C12 25MF
AVC
C15 150
E1 AVC DET
R15 6.8K
C16 .01
R16 560
T2
E2 AF DET
VOLUME
C17 .01
R18A 10K
C20 6.4MF
R20 680
C18 .47
TONE
R18B 100K
R19 3.3K
C19 .2
R17 180K
R22 1M
C22A 100MF
R21 270
Q4 54D DRIVER
C21 .005
T3
WHT
YEL
R24 470
R25 10
R29 3.3M
C23 .03
Q5 SP1556-4 PWR AMP
Q6 SP1556-4 PWR AMP
R26 .16
R27 .16
C26 .03
L1
C25 .001
C27 .001
REAR SEAT SPKR PLUG
E6 40Ω
SHORTING BAR
R28 150
REAR SPEAKER CONTROL
OE67A & PC67A ONLY
TM17A ONLY
LUMALERT
T4
Q7 2SB54 LUMALERT AUDIO OSC
R30 680
R31 27
R32 47
R33 82
R29 470
C28 .001
LUMALERT DEFEAT SW
E7
TO TAIL LIGHT WIRING
ON-OFF SW (ON VOL CONT)
L6 .42Ω
C24 .001
E5 5 AMP
RADIO POWER LEAD 14VDC
R23 270
C22B 500MF
C22C 500MF
E4
E3 D1A REGULATOR
R30 100
L2, L3, L4 & L5 CONNECTIONS
T1 & T2 BOT VIEW
E1 & E2 DETAIL
Q1 THRU Q3
Q4
Q5 & Q6
Q7
TRANSISTOR CONN BOT VIEW
S=SILICON
G=GERMANIUM
T4 CONN BOT VIEW
DIAG. 63D64992A50-SPCL

NOTE:

ON L2, L3, L4 & L5 CONNECTION DETAIL, BOT REFERS TO LEAD AT BOTTOM OF COIL, I.E. NEAREST THE TERMINAL STRIP. THE SECONDARY WINDING IS THE OUTERMOST WINDING.

NOTES:

CAPACITORS - UNLESS OTHERWISE SPECIFIED, DECIMAL VALUES IN MF, ALL OTHERS IN PF.

VOLTAGES - MEASURED FROM POINT INDICATED TO ⏚ WITH VTVM ± 10%, VOL AT MIN.

WHEN TWO VOLTAGES ARE SHOWN
UPPER V- WITH NO SIGNAL INPUT.
LOWER V- WITH STRONG SIGNAL INPUT.

INPUT VOLTAGE - 14V DC.

TUNING RANGE - 540KC TO 1610KC

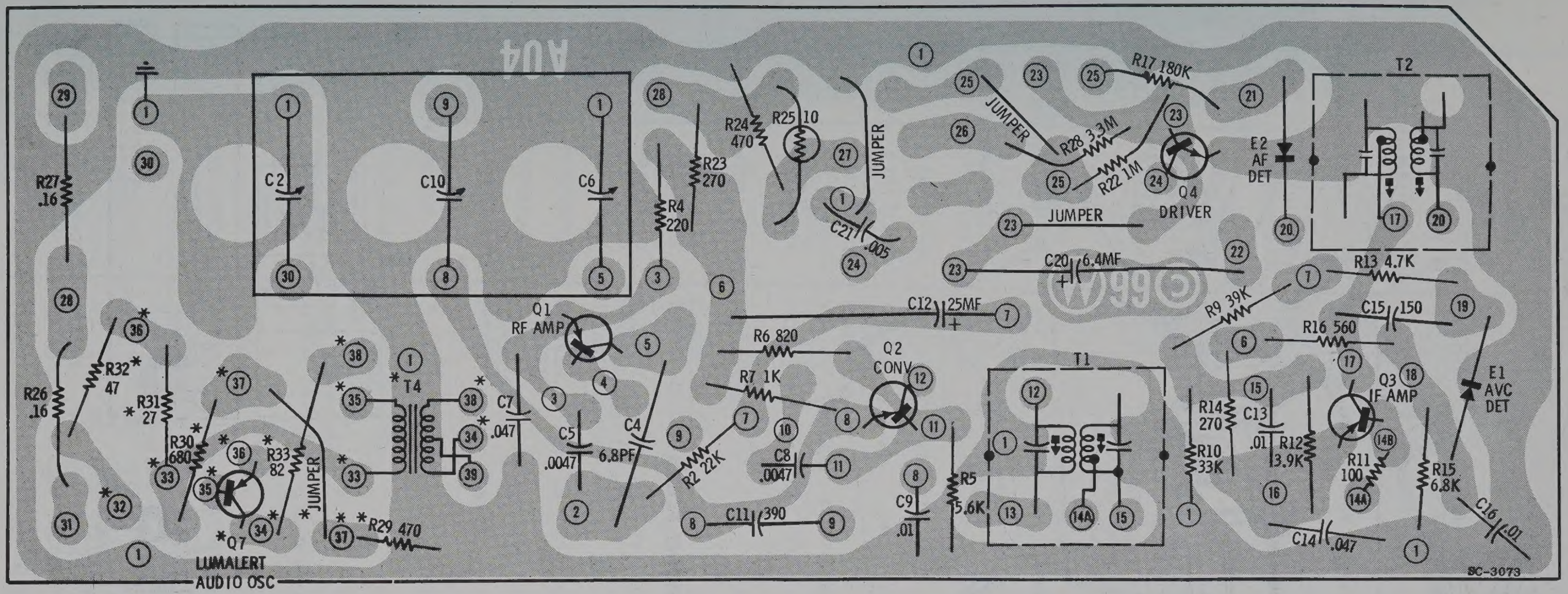
IF FREQ - 262.5KC

*LUMALERT SOUNDING

CAUTION

RADIO POWER LEAD MUST BE CONNECTED TO POSITIVE (+) SIDE OF POWER SUPPLY. RADIO WILL NOT OPERATE AND DAMAGE TO COMPONENTS WILL RESULT IF CONNECTED OTHERWISE.

SCHEMATIC DIAGRAM - ALL MODELS

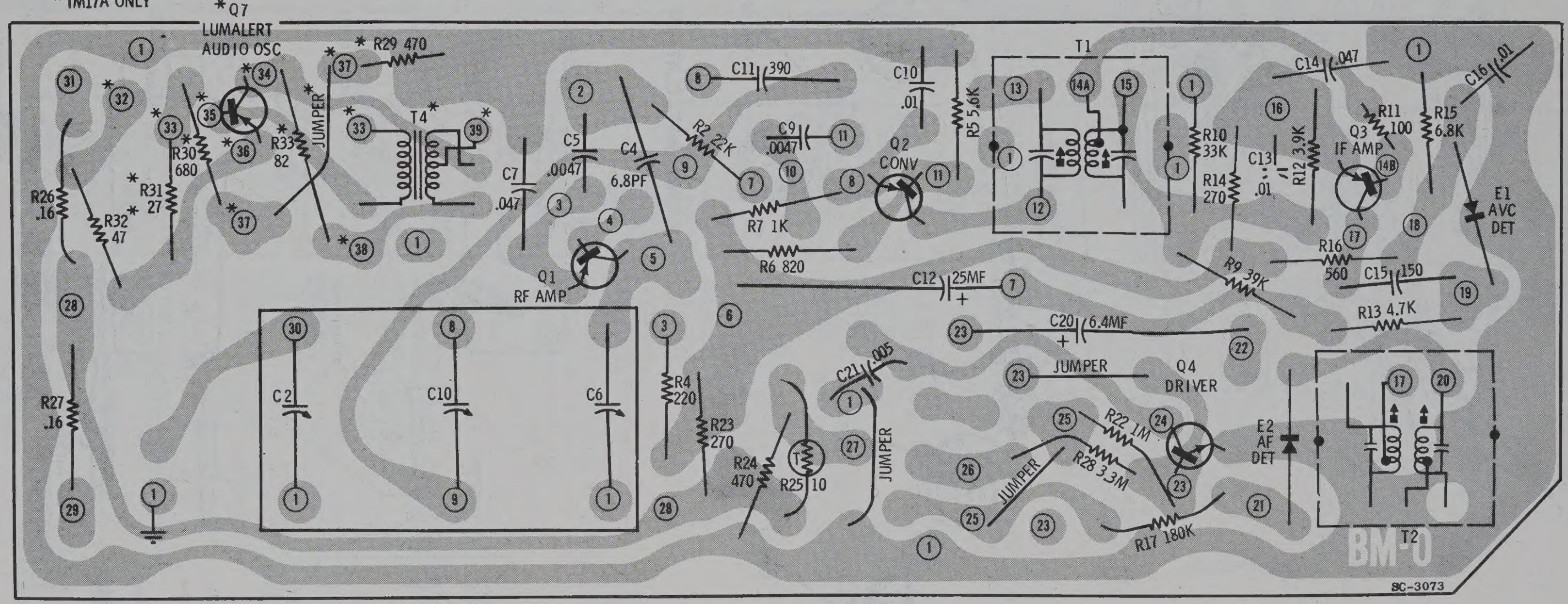

A04
C2
C10
C6
R27 .16
R26 .16
R32 47
R31 27
R30 680
R33 82
JUMPER
Q7
LUMALERT
AUDIO OSC
R29 470
T4
C7 .047
C5 .0047
C4 6.8PF
Q1
RF AMP
R2 22K
R24 470
R25 10
R23 270
R4 220
C21 .005
JUMPER
R6 820
R7 1K
C8 .0047
C11 390
C12 25MF
Q2
CONV
C9 .01
R5 5.6K
T1
R28 3.3M
R22 1M
R17 180K
Q4
DRIVER
C20 6.4MF
R9 39K
R14 270
R10 33K
C13 .01
R12 3.9K
R16 560
C15 150
R13 4.7K
Q3
IF AMP
R11 100
C14 .047
R15 6.8K
C16 .01
E1
AVC
DET
E2
AF
DET
T2
SC-3073

*TM17A ONLY

TOP VIEW

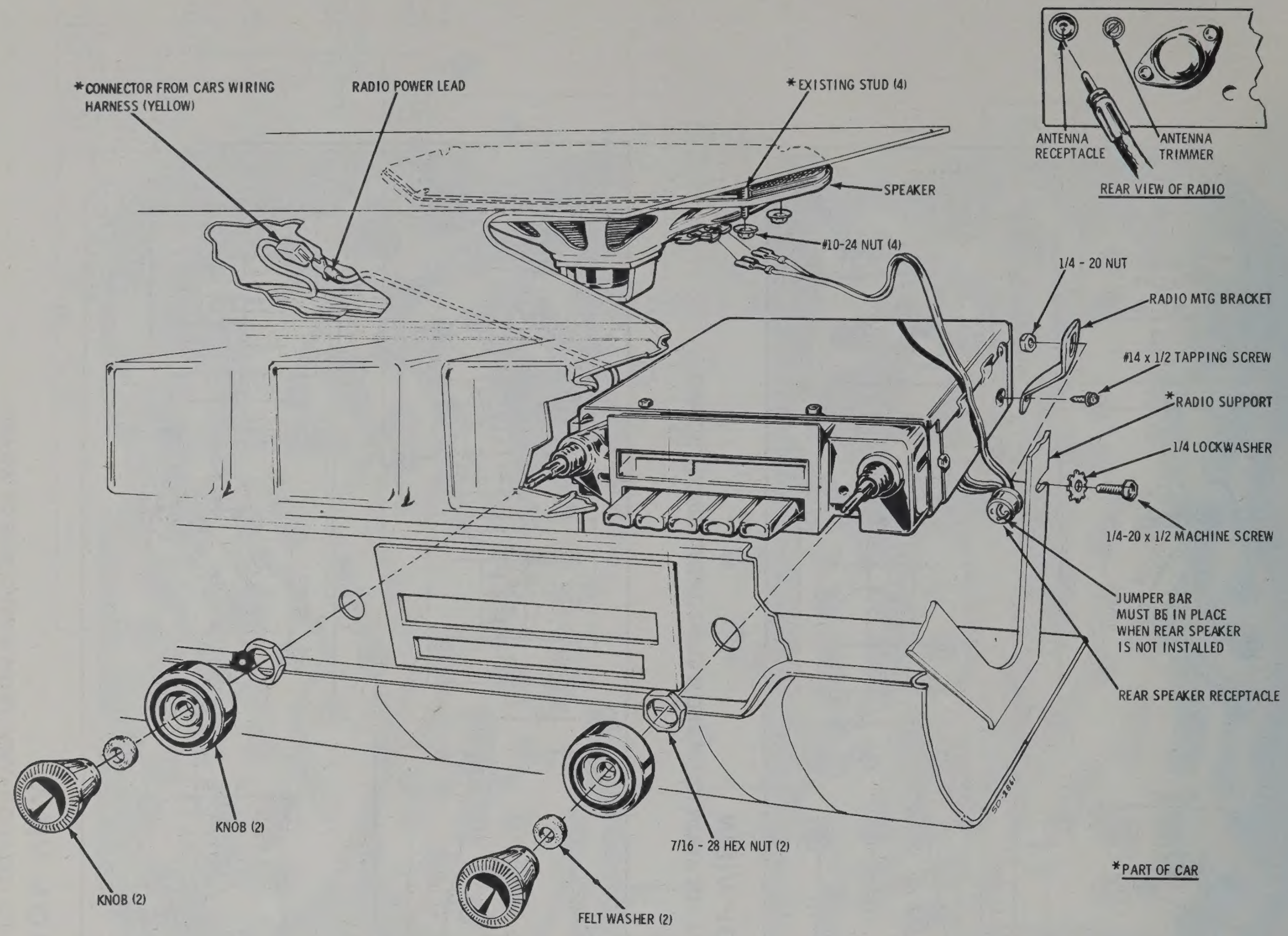
PLATED CHASSIS REFERENCE POINTS AND PARTS LOCATION (VIEW FROM COMPONENT SIDE OF BOARD)

*TM17A ONLY

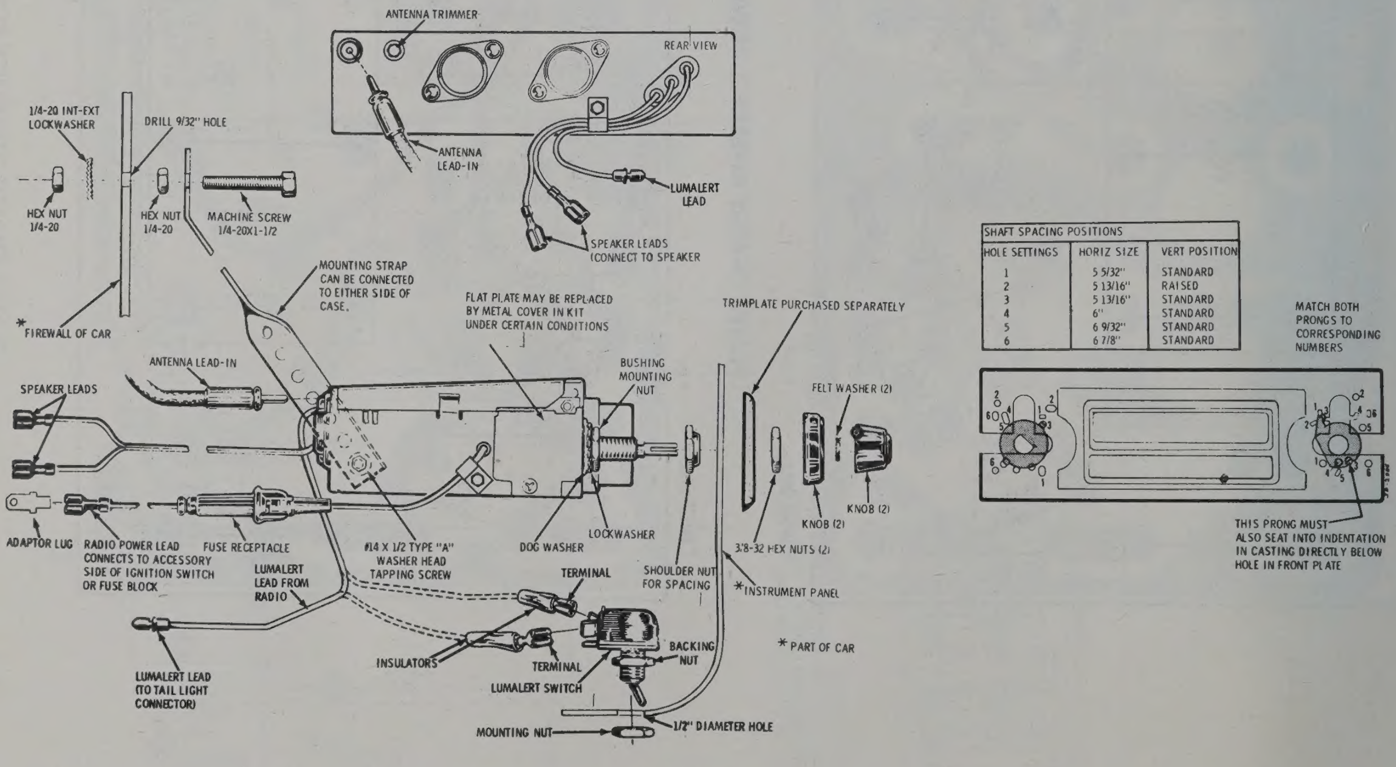

*Q7
LUMALERT
AUDIO OSC
R29 470
R26 .16
R32 47
R31 27
R30 680
R33 82
JUMPER
T4
C7 .047
C5 .0047
C4 6.8PF
Q1
RF AMP
R2 22K
C11 390
C9 .0047
R7 1K
R6 820
C10 .01
R5 5.6K
Q2
CONV
C12 25MF
T1
R10 33K
R14 270
C13 .01
R12 3.9K
C14 .047
R11 100
Q3
IF AMP
R15 6.8K
C16 .01
E1
AVC
DET
R16 560
C15 150
R9 39K
R13 4.7K
C20 6.4MF
JUMPER
Q4
DRIVER
R22 1M
R28 3.3M
R17 180K
E2
AF
DET
T2
C2
C10
C6
R27 .16
R4 220
R23 270
R24 470
R25 10
C21 .005
JUMPER
BM-0
SC-3073

BOTTOM VIEW

PLATED CHASSIS REFERENCE POINTS AND PARTS LOCATION (VIEW FROM WIRING SIDE OF BOARD)


*CONNECTOR FROM CARS WIRING HARNESS (YELLOW)
RADIO POWER LEAD
*EXISTING STUD (4)
SPEAKER
#10-24 NUT (4)
ANTENNA RECEPTACLE
ANTENNA TRIMMER
REAR VIEW OF RADIO
1/4 - 20 NUT
RADIO MTG BRACKET
#14 x 1/2 TAPPING SCREW
*RADIO SUPPORT
1/4 LOCKWASHER
1/4-20 x 1/2 MACHINE SCREW
JUMPER BAR MUST BE IN PLACE WHEN REAR SPEAKER IS NOT INSTALLED
REAR SPEAKER RECEPTACLE
KNOB (2)
KNOB (2)
7/16 - 28 HEX NUT (2)
FELT WASHER (2)
*PART OF CAR
SD-3841

RADIO INSTALLATION DETAIL - MODEL PC67A


ANTENNA TRIMMER
REAR VIEW
ANTENNA LEAD-IN
LUMALERT LEAD
SPEAKER LEADS (CONNECT TO SPEAKER
1/4-20 INT-EXT LOCKWASHER
DRILL 9/32" HOLE
HEX NUT 1/4-20
HEX NUT 1/4-20
MACHINE SCREW 1/4-20X1-1/2
MOUNTING STRAP CAN BE CONNECTED TO EITHER SIDE OF CASE.
*FIREWALL OF CAR
FLAT PLATE MAY BE REPLACED BY METAL COVER IN KIT UNDER CERTAIN CONDITIONS
TRIMPLATE PURCHASED SEPARATELY
ANTENNA LEAD-IN
SPEAKER LEADS
BUSHING MOUNTING NUT
FELT WASHER (2)
KNOB (2)
KNOB (2)
ADAPTOR LUG
RADIO POWER LEAD CONNECTS TO ACCESSORY SIDE OF IGNITION SWITCH OR FUSE BLOCK
FUSE RECEPTACLE
#14 X 1/2 TYPE "A" WASHER HEAD TAPPING SCREW
DOG WASHER
LOCKWASHER
3/8-32 HEX NUTS (2)
LUMALERT LEAD FROM RADIO
TERMINAL
SHOULDER NUT FOR SPACING
*INSTRUMENT PANEL
INSULATORS
TERMINAL
BACKING NUT
LUMALERT SWITCH
*PART OF CAR
LUMALERT LEAD (TO TAIL LIGHT CONNECTOR)
MOUNTING NUT
1/2" DIAMETER HOLE
MATCH BOTH PRONGS TO CORRESPONDING NUMBERS
THIS PRONG MUST ALSO SEAT INTO INDENTATION IN CASTING DIRECTLY BELOW HOLE IN FRONT PLATE
1
2
3
4
5
6

SHAFT SPACING POSITIONS

HOLE SETTINGS	HORIZ SIZE	VERT POSITION
1	5 5/32"	STANDARD
2	5 13/16"	RAISED
3	5 13/16"	STANDARD
4	6"	STANDARD
5	6 9/32"	STANDARD
6	6 7/8"	STANDARD

RADIO INSTALLATION DETAIL - MODEL TM17A

REPLACEMENT PARTS LIST

COMBINED ELECTRICAL PARTS

CAPACITORS - NOTE: The capacitors in this list are recommended replacement types for the original equipment; all are ceramic disc type unless otherwise specified.

Ref. No.	Part Number	Description
C-1	20C542758	TRIMMER
C-2	*20C64352A05	TRIMMER: C-2 - 10 to 80 pf; C-10 - 65 to 200 pf; C-6 - 10 to 80 pf
C-3	8S10064A34	.003 mf 10% 200V mylar (USE 8R10110A02)
C-4	21S120157	6.8 pf 10% 500V
C-5	8S10192A01	.0047 mf 20% 100V mylar
C-6	---	SEE C-2
C-7	8S10192A03	.047 mf 20% 100V mylar
C-8	8S10192A01	.0047 mf 20% 100V mylar
C-9	8S10192A02	.01 mf 20% 100V mylar (USE 8C42750A06)
C-10	---	SEE C-2
C-11	8S10100A14	390 pf 5% 125V N150 mylar
C-12	23S187A02	25 mf 25V lytic
C-13	21S180C54	.01 mf +80-20% 100V (USE 21S132103)
C-14	8S10192A03	.047 mf 20% 100V mylar
C-15	21S132491	150 pf 10% 100V N750
C-16	21S180C54	.01 mf +80-20% 100V (USE 21S132103)
C-17	21S482726	.01 mf +100-0% 500V
C-18	21S10003A01	.47 mf +100-0% 3V (OE67A, PC67A)
C-19	21S10003A08	.2 mf +80-20% 10V
C-20	23S187A01	6.4 mf 40V lytic
C-21	21S132493	.005 mf +80-20% 250V (USE 21R131999)
C-22	23S184A05	500-500-100 mf/16V (USE 23C64722A02)
C-23	21D40339A53	.03 mf +80-20% 100V
C-24	21A560232	FEED-THRU
C-25	21A560232	FEED-THRU
C-26	21D40339A53	.03 mf +80-20% 100V
C-27	21A560232	FEED-THRU
C-28	21A560232	FEED-THRU (TM17A)

MISCELLANEOUS ELECTRICAL PARTS

Ref. No.	Part Number	Description
E-1	48C134587	DIODE, 1N139
E-2	48C134587	DIODE, 1N139
E-3	48S134912	D1A
E-4	65R538410	BULB, dial: .11A-14.4V
E-5	65S122345	FUSE, 5 amp (TM17A)
E-6	1V64954A92	SPEAKER ASSEM: 4 x 10 PM: 40Ω VC (OE67A)
	50D64373A02	SPEAKER, 4 x 10 PM: 40Ω VC (PC67A)
	50D64797A01	SPEAKER, 4 x 10 PM: 40Ω VC (TM17A)
E-7	40B64163A01	SWITCH, rotary (TM17A)

COILS & CHOKES

Ref. No.	Part Number	Description
L-1	25C64173A01	CHOKE, output
L-2, L-3, L-4 & L-5	---	SEE TUNER PARTS
L-6	25C64172A01	CHOKE, filter

CONTROLS & RESISTORS

Ref. No.	Part Number	Description
R-18	*18C64062A02	CONTROL, vol-tone-sw (OE67A)
	18C64588A08	CONTROL, vol-tone-sw (PC67A)
	18C64668A03	CONTROL, vol-tone-sw (TM17A - USE 18C64668A02)
R-25	6K544646	10 10% 1/2W NTC
R-26	17B64753A01	.16 10% WW (USE 17A64856A01)
R-27	17B64753A01	.16 10% WW (USE 17A64856A01)
R-28	18B64440A05	CONTROL, rear spkr (OE67A)
	18B64440A04	CONTROL, rear spkr (PC67A)

TRANSFORMERS

Ref. No.	Part Number	Description
T-1	24C64327A03	1ST IF
T-2	24C64327A02	2ND IF
T-3	25D64174A01	DRIVER
T-4	25S10150A02	LUMALERT (TM17A)

TRANSISTORS

Ref. No.	Part Number	Description
Q-1	48S134830	829A (USE 48S134831)
Q-2	48S134831	829B
Q-3	48S134832	829C (USE 48S134831)
Q-4	48S134811	54D
Q-5	48S134761	SP1556-4 (USE 48S134759)
Q-6	48S134761	SP1556-4 (USE 48S134759)
Q-7	48S134907	2SB54 (TM17A)

MECHANICAL PARTS - MODEL OE67A

Ref. No.	Part Number	Description
	84C64111A04	BOARD, plated chassis
	7B64267A01	BRACKET, dial bkgnd
	7B64263A01	BRACKET, dial ret
	7A64268A01	BRACKET, spkr mtg
	15C64077B01	COVER, back
	15C64366A02	COVER, top
	13D64257A01	ESCUTCHEON, dial
	14A543810	INSULATOR, trans
	36C64081B02	KNOB, rear spkr
	36C64081B01	KNOB, tone
	36C64109B01	KNOB, vol-tuning
	29A541679	LUG, terminal: pwr lead
	29A64778A01	LUG, terminal: spkr leads
	2S119613	NUT, hex: 7/16-28 (radio mtg)
	2S121841	NUT, hex: 6-32 x 5/16 (cover to heat sink)
	2S10101A29	NUT, push-on: dial ret
	*13C64101B01	OVERLAY, escut
	75K544829	PAD, spkr
	28A533126	PLUG, shorting: rear spkr recept
	9K690618	RECEPTACLE, 4-pin: rear spkr
	9A64021A01	RECEPTACLE, ant
	34B64253A01	SCALE, dial
	3K560695	SCREW, tpg: #6 x 1/2 (trans mtg)
	15A690616	SHELL & INSULATOR: rear spkr recept
	9K544808	SOCKET, dial light (USE 9K544543)
	9B542339	SOCKET, trans
	46B562381	STUD, trimount: control cover
	4S10059A09	WASHER, spring: spkr cont

MECHANICAL PARTS - MODEL PC67A

Ref. No.	Part Number	Description
	*84C64111A04	BOARD, plated chassis
	7B64555A01	BRACKET, dial bkgnd
	7B64254A01	BRACKET, dial ret
	42K544832	CLIP, dial ret
	*15C64077B01	COVER, back
	15C64359A03	COVER, top
	13D64260A01	ESCUTCHEON, dial
	14A543810	INSULATOR, trans
	36B64174B01	KNOB, on-off, vol & tuning
	36B64049A02	KNOB, tone & spkr
	29A541679	LUG, term: pwr lead
	29A64778A01	LUG, term: spkr leads
	2S2879	NUT, hex: 7/16 x 5/8 (front radio mtg - USE 2K2869)
	2S121841	NUT, hex: 6-32 x 5/16 (cover to heat sink)
	28A533126	PLUG, shorting: rear spkr recept
	9K690618	RECEPTACLE, 4-pin: rear spkr
	9A64021A01	RECEPTACLE, ant
	34B64245A01	SCALE, dial
	3K560695	SCREW, tpg: #6 x 1/2 (trans mtg)
	15A690616	SHELL & INS: rear spkr recept
	9K544808	SOCKET, dial lite (USE 9K544543)
	9B542339	SOCKET, trans
	46B562381	STUD, trimount: cont cover
	4S10059A09	WASHER, spring: spkr cont

MECHANICAL PARTS - MODEL TM17A

Ref. No.	Part Number	Description
	84C64111A04	BOARD, plated chassis
	7B64664A02	BRACKET, dial bkgnd
	15C64077B01	COVER, back
	15C64366A02	COVER, top
	13C64661A01	ESCUTCHEON, dial
	14A543810	INSULATOR, trans
	36K543399	KNOB, pendant
	36B543398	KNOB, tone
	36B543382	KNOB, vol-tone-sw
	29K534326	LUG, term: fuse recept
	29K544855	LUG, term: rotary sw
	29A64778A01	LUG, term: spkr leads
	13K544854	MASK, dial
	2S8382	NUT, hex: 15/32-32 x 9/16 (rotary sw)

Ref. No.	Part Number	Description
	2S119601	NUT, hex: 3/8-32 (vol cont)
	2S121841	NUT, hex: 6-32 x 5/16
	2S10101A29	NUT, push-on: dial & mask ret
	29A64297A01	PLUG, term: lumalert
	9A64021A01	RECPETACLE, antenna
	1V64964A32	RECEPTACLE, fuse: compl
	34B64284A01	SCALE, dial
	3K560695	SCREW, spcl: trans mtg
	9K544808	SOCKET, dial lite (USE 9K544543)
	9B542339	SOCKET, trans
	42K544845	STRAP, radio mtg
	46B562381	STUD, trimount: cont cover
	4A64362A01	WASHER, dog: cont spacing

INSTALLATION PARTS - MODEL OE67A

	*1V64966A45	RADIO INSTALLATION KIT
	*7B64107B01	BRACKET, radio mtg
	30K542673	CABLE, ground: 4" (USE 30B538347)
	30K544768	CABLE, ground: 6"
	8K544722	CAPACITOR, ignition coil
	8A4491	CAPACITOR, noise suppr
	65S131812	FUSE, 4 amp: 7AG-4A
	2S119613	NUT, hex: 7/16-28
	3S127873	SCREW, tpg: 1/4-20

INSTALLATION PARTS - MODEL PC67A

	*1V64966A51	RADIO INSTALLATION KIT
	7A64414A01	BRACKET, radio mtg
	30K542673	CABLE, ground: 4" (USE 30B538347)
	30K544797	CABLE, ground: 8-1/2" (USE 30K544831)
	65S61688	FUSE, 4 amp: 3AG
	*2S7020	NUT, hex: 3/8-28
	2S2878	NUT, hex: 1/4-20
	2S10080A02	NUT, hex: 10-24 (spkr mtg)
	3S132240	SCREW, tpg: #14 x 1/2 (brkt & cable mtg)

INSTALLATION PARTS - MODEL TM17A

	1V64952A32	RADIO INSTALLATION KIT
	45K538873	ARM, adaptor: fuse recept
	8A4491	CAPACITOR, noise suppr
	14A64296A01	INSULATOR, lug: lumalert lug
	29A64295A01	LUG, terminal: lumalert splice conn
	2S121771	NUT, hex: 3/8-32 (radio mtg)
	2S2878	NUT, hex: 1/4-20 (strap mtg)
	2A64784A01	NUT, shoulder: front radio spacing
	3S9694	SCREW, mach: 1/4-20 x 1-1/2 (strap mtg)

TUNER PARTS - MODEL OE67A

	*77D43039A06	TUNER, AT631: compl
	43K471633	BEARING, ball
	1A562758	CLUTCH & DISC ASSEM: incl set screw
	1V41700A95	COILS & MTG PLATE ASSEM: incl L-2, L-3, L-4, L-5
	76K563286	CORE, tuning: ant & RF
	76K563288	CORE, tuning: osc
	1C41794A02	CROWN GEAR & PINION ASSEM: incl spring
	1K565223	GEAR, BUSHING & DISC ASSEM: incl spring
	5B562438	GROMMET, core mtg
	52C42062A21	POINTER, dial
	38C40283B02	PUSHBUTTON: first, third & fifth
	38C40283B01	PUSHBUTTON: second & fourth
	49A562480	ROLLER, clutch rel
	1V562830	SCREW & NUT ASSEM: adjust
	3A563128	SCREW, set: 4-40 x 1/4 (clu & disc assem)

Ref. No.	Part Number	Description
	3S132220	SCREW, tpg: #4 x 5/16 (coils & mtg plate assem)
	*47A40452A88	SHAFT, tuning
	41A562449	SPRING, anti-rattle: clu rel brkt
	41A562447	SPRING, clutch rel
	41B562503	SPRING, pointer tension
	41K560445	SPRING, ret: tuning shaft
	4K692188	WASHER, "C": pointer ret
	4A562431	WASHER, cup: clu rel brkt

TUNER PARTS - MODEL PC67A

	77D41925A03	TUNER, AT541: complete
	43K471633	BEARING, ball
	1A562758	CLUTCH & DISC ASSEM: incls screw
	1V41700A95	COILS & MTG PLATE ASSEM: incls L-2, L-3, L4, L-5
	76K563286	CORE, tuning: ant & RF
	76K563288	CORE, tuning: osc
	1C41794A02	CROWN GEAR & PINION ASSEMBLY
	1K565223	GEAR, BUSHING & DISC ASSEM: incls spring
	5B562438	GROMMET, core mtg
	1B40875A12	POINTER, dial
	38C44097A03	PUSHBUTTON, first, third & fifth
	38C44097A01	PUSHBUTTON, second & fourth
	49A562480	ROLLER, clutch rel
	1V562830	SCREW & NUT ASSEM: adjust
	3A563128	SCREW, set: 4-40 x 1/4 (clutch assem)
	47C40452A67	SHAFT, manual tuning
	41A562449	SPRING, anti-rattle: clutch rel
	41A562447	SPRING, clutch rel
	41B562503	SPRING, pointer tension
	41K560445	SPRING, retaining: tuning shaft
	4K692188	WASHER, "C": pointer
	4A562431	WASHER, cup: clutch rel

TUNER PARTS - MODEL TM17A

	77D42935A06	TUNER, AT576: complete
	43K471633	BEARING, ball
	45A40838A01	BRACKET, link: manual tuning
	43B41624A01	BUSHING, tuning shaft: manual tuning shaft
	1A562758	CLUTCH & DISC ASSEM: incls set screw
	1V41700A95	COILS & MTG PLATE ASSEM: incls L-2, L-3, L-4, L-5
	76K563286	CORE, tuning: ant & RF
	76K563288	CORE, tuning: osc
	1C41794A10	CROWN GEAR & SHAFT ASSEM: incls pinion gear
	1B40846A01	DRIVE DISC & SPACER ASSEM: manual tuning
	1B562642	GEAR, BUSHING & DISC ASSEM: incls spring
	5B562438	GROMMET, core mtg
	2K560468	NUT, hex: 3/8-32 (tuning shaft bushing mtg)
	1B40847A02	PINION SHAFT & DISC ASSEM: manual tuning
	1B40875A01	POINTER, dial
	38B563819	PUSHBUTTON
	49A562480	ROLLER, clutch rel
	1V562830	SCREW & NUT ASSEM: adjust
	3A563128	SCREW, set: 4-40 x 1/4 (clutch & disc assembly)
	1A40844A03	SHAFT, manual tuning: incls drive disc
	41A562449	SPRING, anti-rattle: clutch
	41A562447	SPRING, clutch rel
	41B562503	SPRING, pointer tension
	4K601456	WASHER, "C": manual tuning shaft ret
	4K692188	WASHER, "C": pointer spring
	4A562431	WASHER, cup: bearing ret
	4A41625A01	WASHER, shaft bearing: manual tuning shaft
	4C40104A04	WASHER, spring: drive disc & spacer ret
	4A42901A01	WASHER, stop: tuning shaft bushing

*DENOTES NEW ITEM APPEARING IN ANY LIST FOR FIRST TIME.

auto radio fm converter

MANUAL 68P64994A65

MODEL FM67M

MOTOROLA service manual

GENERAL INFORMATION

All-transistor FM car radio converter designed for under-dash mounting in cars having a 12 volt negative ground battery. The AM output frequency is 1400Kc, ±30Kc.

SERVICE NOTES

1. Make certain the "A" lead is connected to the positive (+) side of the power source, otherwise, damage to receiver may result. If a battery eliminator is used as a power source in place of a battery, it must be well filtered and regulated.

2. When replacing transistors, use long-nose pliers as a heat sink, i.e., grasp transistor leads close to transistor base with the pliers to dissipate heat while soldering.

3. Servicing techniques applicable to this model can be found in the following Motorola publications: "Profitable Transistor Radio Servicing" (Motorola Part Number 68P60011A53) and "A Discussion Of Transistorized Car Radios" (Motorola Part No. 68P64980A51).

TUNER REMOVAL AND REPLACEMENT

1. Set tuner pointer to low end stop (88Mc).

2. Remove knobs, bottom cover and front escutcheon.

3. Unsolder all leads to tuner.

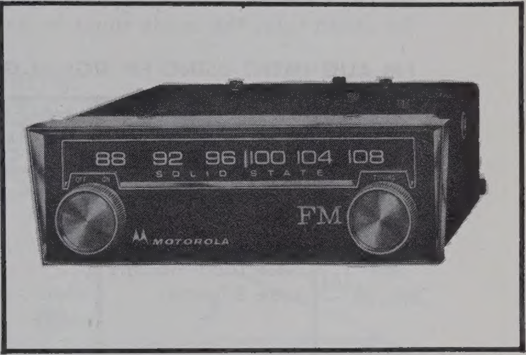
4. To avoid dial restringing later, tape dial cord to tuning shaft.

5. Remove dial background and pointer.

6. Remove two (2) screws that mount tuner assembly to housing, then pull out tuner assembly and tuning shaft (with dial cord) out of housing.

7. Place a rivet or suitable pin through both of the 1/8" holes in the large nylon gears on the tuning shaft; it is important that these holes remain in line with each other so that both gears are properly spring-loaded thereby eliminating pointer backlash when the gears are re-assembled to the tuning shaft (see "Parts Location - Bottom View").

8. Remove three (3) tuner mounting screws from bracket and remove tuner from bracket.



9. Remove the 4-40 set screw from the nylon gears to remove the gears from the shaft on the tuner.

10. Before re-assemblying gears to tuner, make sure tuning shaft of tuner is rotated fully clockwise (as viewed from shaft end of tuner) and control shaft is fully counter-clockwise.

11. Re-assemble tuner to housing, reversing the procedure used to remove it, then remove rivet or pin from large nylon gears after meshing large and small gears.

12. To re-set pointer, see "Dial Stringing Detail".

MOTOROLA AUTO RADIO WARRANTY SERVICE STATION PROCEDURE

1. A Motorola Branded Model is one that has the Motorola name and is distributed to dealers through the Motorola Distributor.

2. These models are guaranteed for all parts and labor, including removal and re-installation (R & R), for a period of two years from the date of purchase. The following repairs are not covered under this guarantee: the elimination of motor noise, tire static, electrical interference and faulty installation. Charges for these repairs are to be paid by the customer.

3. Before performing a guarantee repair on a Motorola Branded Auto Radio, you must first receive the Customer's Car Radio Guarantee and Service Booklet. The installation and model information on the booklet must be filled in by the selling dealer at the time of retail sale. The Customer's Car Radio Guarantee and Service Booklet must show that the radio is within the guarantee period to be repaired under the Motorola Auto Radio Guarantee.

4. To obtain your labor allowance for the servicing of the customers in-guarantee set, fill in the Motorola Guarantee Labor Claim, Part No. 68P60016A30. If you perform a R & R service, you are entitled to the R & R allowance. If you only repair the radio without R & R service, you are entitled to the labor allowance. However, if you perform both R & R and the repair, then be sure to indicate both on your claim form for both allowances. After the form has been filled in, mail the pink and green copies to your Motorola Distributor for payment. The yellow copy is to be retained in the Service Station file.

5. Defective parts for guarantee repairs made are to be sent to your Motorola Distributor for free replacement supported with the defective parts return tag, Part Number 54P591808.

6. Only those service stations authorized by their Motorola Distributor can perform repairs within the guarantee period on a no-charge basis to the customer. If you are not an Authorized Motorola Auto Radio Service Station and you are interested in handling this service, please contact your Motorola Distributor for complete details.

MOTOROLA INC. 9401 WEST GRAND AVENUE, FRANKLIN PARK, ILLINOIS

PART NO. 68P64994A65 2-67 PRICE 20 CENTS
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ALIGNMENT

GENERAL INFORMATION - The factory alignment is performed with laboratory equipment. The circuits are quite stable and not ordinarily subject to drift; therefore, before alignment is attempted, the set should be thoroughly checked for circuit troubles. During alignment, all covers should be in place and securely tightened (unless it is impossible to gain access to a test point through the cover). An AM or FM generator can be used for FM alignment. The test points referred to in the alignment procedure are identified on the schematic and their physical location shown in the "Alignment Detail".

ALIGNMENT CONDITIONS - Input voltage to the receiver 14V DC. During FM alignment the input signal amplitude must be kept below the limiting level. To check this, change the generator attenuator setting and note where further increase in input does not increase the output reading. The input signal level must be attenuated to keep the output below this level. For the same reason, the signal generator leads must be carefully shielded. If noise voltage on the generator leads is high enough to cause limiting, it is impossible to align the receiver properly because tuning adjustments will show up as variations in the VTVM reading. To avoid this, the leads must be carefully shielded and kept short.

FM ALIGNMENT USING FM SIGNAL GENERATOR

STEP	GENERATOR CONNECTION	GENERATOR FREQUENCY	TUNER SET TO	OUTPUT INDICATOR	ADJUST	REMARKS
FM - IF ALIGNMENT						
1.	Antenna receptacle thru dummy (see Figure)	10.7Mc (22.5Kc sweep width, 400cps mod)	108.5Mc (high end stop)	VTVM-DC probe to point "A", common to chassis	2, 3, 4, 5, 6, 7, 8, 9 & 10	Adjust for maximum positive output (if possible, observe IF waveform on scope for best symmetry of curve while aligning).
2.	"	"	"	VTVM-DC probe to point "B", common to chassis	1	Adjust for zero reading on VTVM; a + or - reading will be obtained on either side of correct setting. Repeat Steps #1 and #2 until no further increase; Step #2 should be last step.
FM - RF ALIGNMENT						
3.	Antenna receptacle thru dummy (see Figure)	87.5Mc (22.5Kc sweep width, 400cps mod)	87.5Mc (low end stop)	VTVM-DC probe to point "A", common to chassis	11, 12, 13 & 14	Adjust for maximum positive output. Make certain input signal is below limiting level.

FM ALIGNMENT USING AM GENERATOR

STEP	GENERATOR CONNECTION	GENERATOR FREQUENCY	TUNER SET TO	OUTPUT INDICATOR	ADJUST	REMARKS
1.	Antenna receptacle thru dummy (see Figure)	10.7Mc (no mod)	108.5Mc (high end stop)	VTVM-DC proble to point "A", common to chassis	2, 3, 4, 5, 6, 7, 8, 9 & 10	Adjust for maximum positive output. Make certain input signal is below limiting level.
2.	"	10.7Mc (no mod)	108.5Mc (high end stop)	VTVM-DC probe to point "B", common to chassis	1	Adjust for zero reading on VTVM; a + or - reading will be obtained on either side of correct setting. Repeat Steps #1 and #2 until no further increase; Step #2 should be last step.
FM - RF ALIGNMENT						
3.	Antenna receptacle thru dummy (see Figure)	87.5Mc (no mod)	87.5Mc (low end stop)	VTVM-DC probe to point "A", common to chassis	11, 12, 13 & 14	Adjust for maximum positive output. Make certain input signal is below limiting level.

1400KC OSCILLATOR ADJUSTMENT

The FM67M is shipped from the factory with the AM oscillator pre-set at 1400Kc and does not require adjustment as part of the FM alignment procedure. However, if adjustment is required, proceed as follows:

A. Install the FM67M into the car and make all electrical connections.

B. Adjust the car's antenna height to approximately 30" measured from the mounting surface to the tip.

C. Turn the AM radio on (and turn off FM67M), tune the AM radio to a weak station around 1400Kc (or to the frequency recommended in the AM radio Owner's Manual). Adjust the antenna trimmer for maximum volume.

D. Tune the AM radio to 1400Kc.

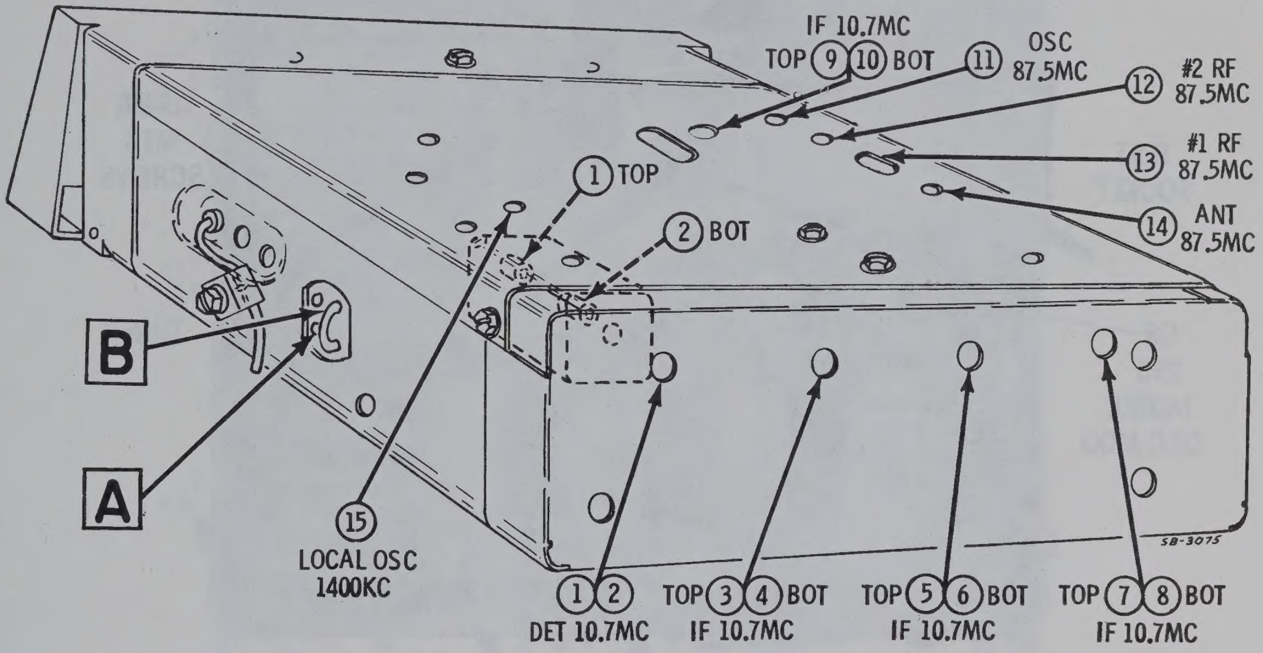
E. Turn on the FM67M and tune in an FM station or noise (if a station cannot be tuned in).

F. Adjust the AM oscillator core (15 - see detail) on FM67M until the FM station or noise is peaked for maximum volume.

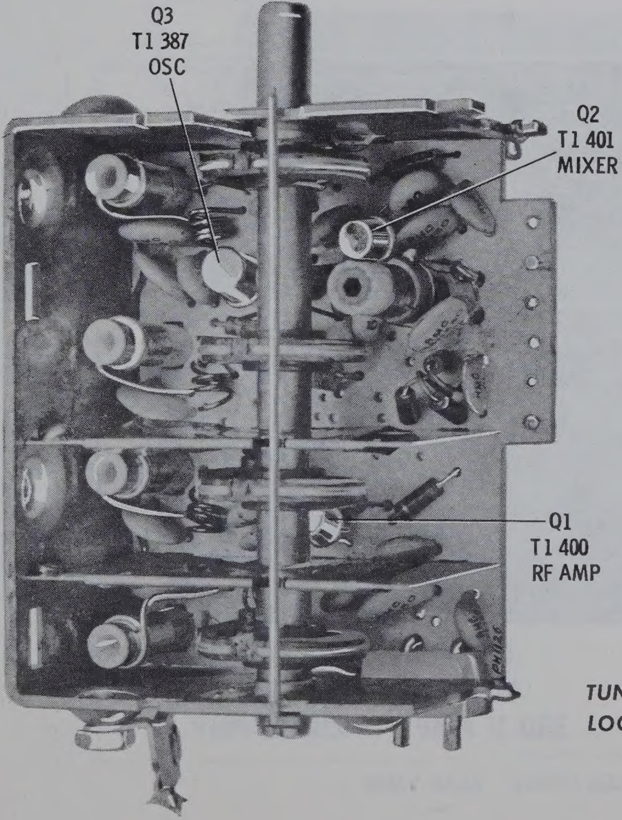
G. With FM67M still turned on, peak AM radio to output of FM67M by rotating AM radio tuning control slightly; if AM radio has pushbuttons, lock one of them to this setting.

If a local AM station interferes on 1400Kc, tune the AM radio to a frequency slightly lower or higher than 1400Kc, then adjust oscillator core (15 on FM67M) as in Step F and AM radio as in Step G.

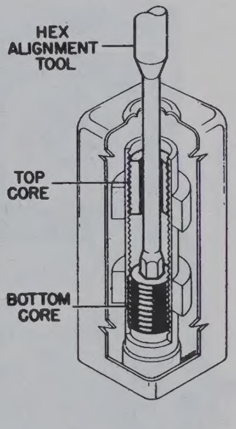
NOTE: The frequency range of the oscillator on the FM67M is approximately ±30Kc.


IF 10.7MC
TOP ⑨ ⑩ BOT
⑪ OSC 87.5MC
⑫ #2 RF 87.5MC
⑬ #1 RF 87.5MC
⑭ ANT 87.5MC
① TOP
② BOT
B
A
⑮ LOCAL OSC 1400KC
① ② DET 10.7MC
TOP ③ ④ BOT IF 10.7MC
TOP ⑤ ⑥ BOT IF 10.7MC
TOP ⑦ ⑧ BOT IF 10.7MC
SB-3075

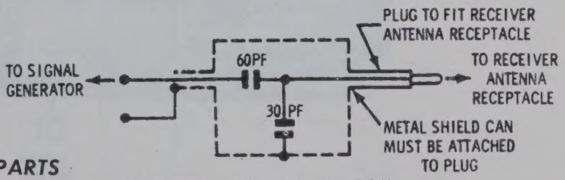
ALIGNMENT LOCATIONS DETAIL


Q3
T1 387
OSC
Q2
T1 401
MIXER
Q1
T1 400
RF AMP

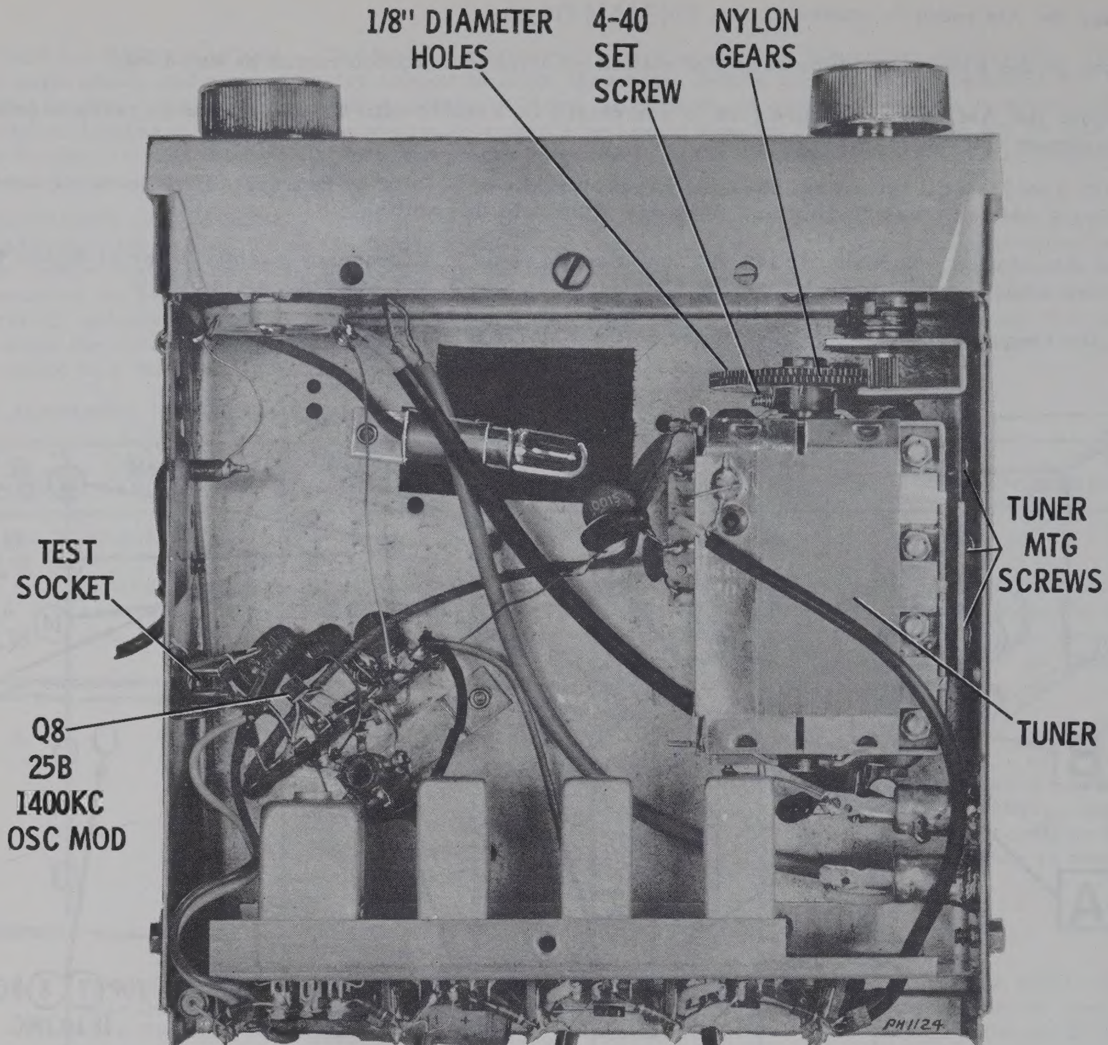
TUNER PARTS LOCATION


HEX ALIGNMENT TOOL
TOP CORE
BOTTOM CORE

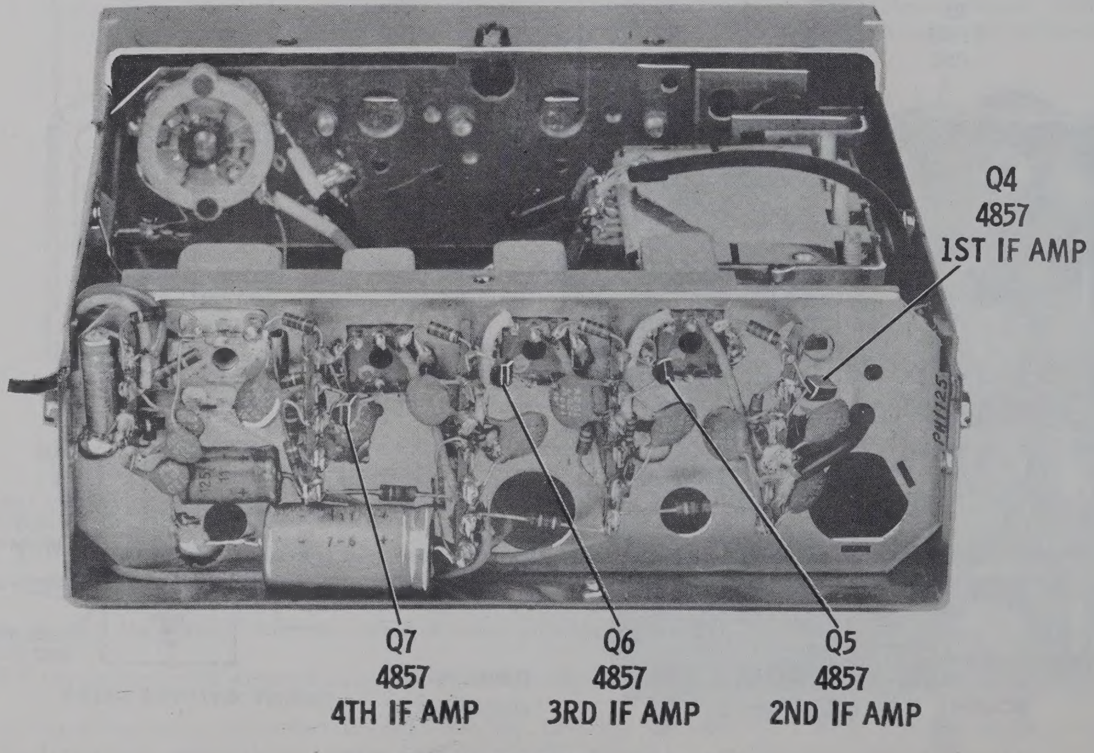
IF ALIGNMENT DETAIL


PLUG TO FIT RECEIVER ANTENNA RECEPTACLE
TO SIGNAL GENERATOR
60PF
30PF
TO RECEIVER ANTENNA RECEPTACLE
METAL SHIELD CAN MUST BE ATTACHED TO PLUG

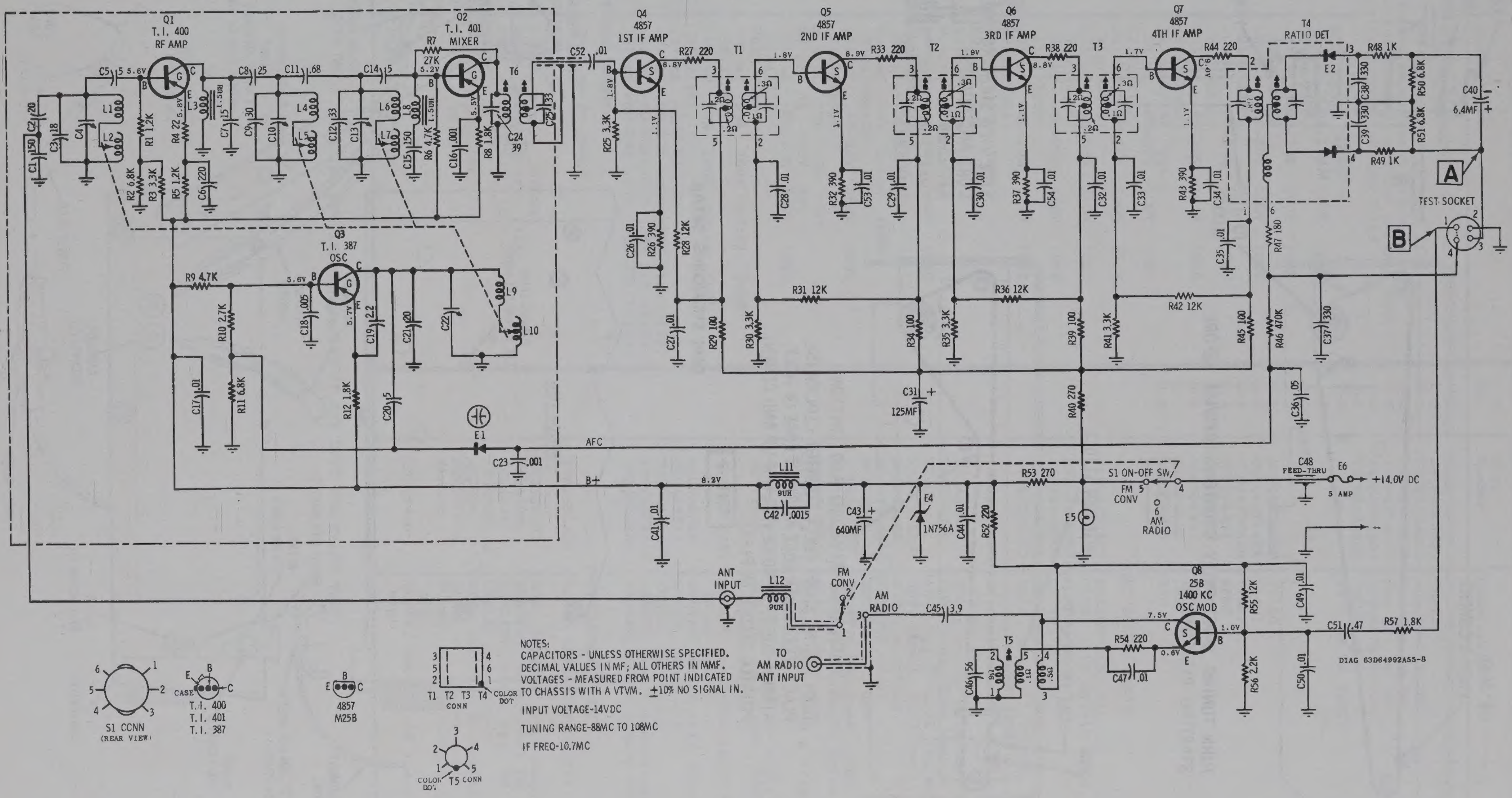
DUMMY ANTENNA DETAIL


1/8" DIAMETER HOLES
4-40 SET SCREW
NYLON GEARS
TUNER MTG SCREWS
TEST SOCKET
TUNER
Q8
25B
1400KC
OSC MOD
PH1124

PARTS LOCATION - BOTTOM VIEW


Q4
4857
1ST IF AMP
PH1125
Q7
4857
4TH IF AMP
Q6
4857
3RD IF AMP
Q5
4857
2ND IF AMP

PARTS LOCATION - REAR VIEW


Q1
T.I. 400
RF AMP
Q2
T.I. 401
MIXER
Q3
T.I. 387
OSC
Q4
4857
1ST IF AMP
Q5
4857
2ND IF AMP
Q6
4857
3RD IF AMP
Q7
4857
4TH IF AMP
T4
RATIO DET
TEST SOCKET
A
B
AFC
B+
8.2V
ANT
INPUT
FM
CONV
AM
RADIO
TO
AM RADIO
ANT INPUT
S1 ON-OFF SW
C48
FEED-THRU
E6
5 AMP
+14.0V DC
Q8
25B
1400 KC
OSC MOD
1N756A
DIAG 63D64992A55-B
S1 CCNN
(REAR VIEW)
CASE
T.I. 400
T.I. 401
T.I. 387
4857
M25B
T1 T2 T3 T4
CONN
COLOR DOT
T5 CONN

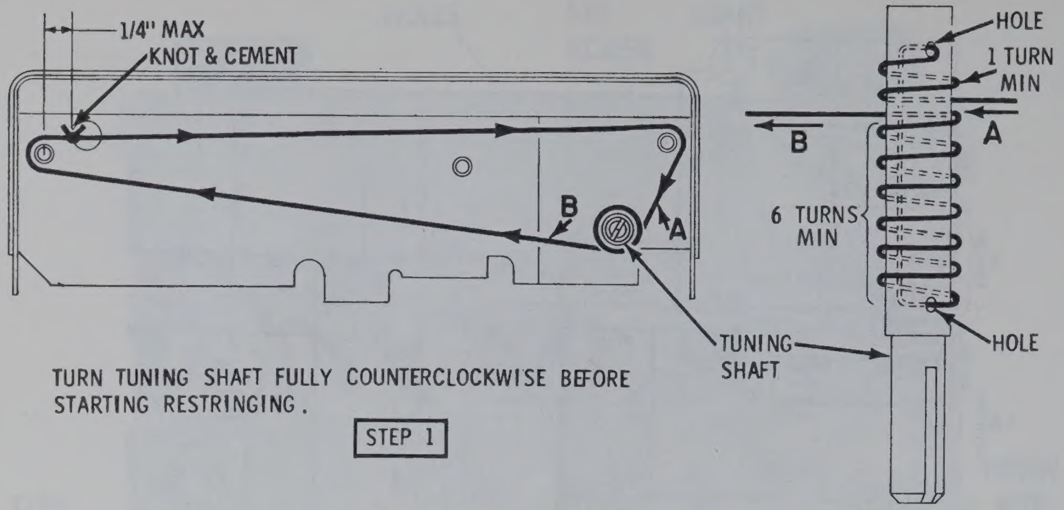
NOTES:
CAPACITORS - UNLESS OTHERWISE SPECIFIED.
DECIMAL VALUES IN MF; ALL OTHERS IN MMF.
VOLTAGES - MEASURED FROM POINT INDICATED
TO CHASSIS WITH A VTVM. ±10% NO SIGNAL IN.

INPUT VOLTAGE-14VDC

TUNING RANGE-88MC TO 108MC

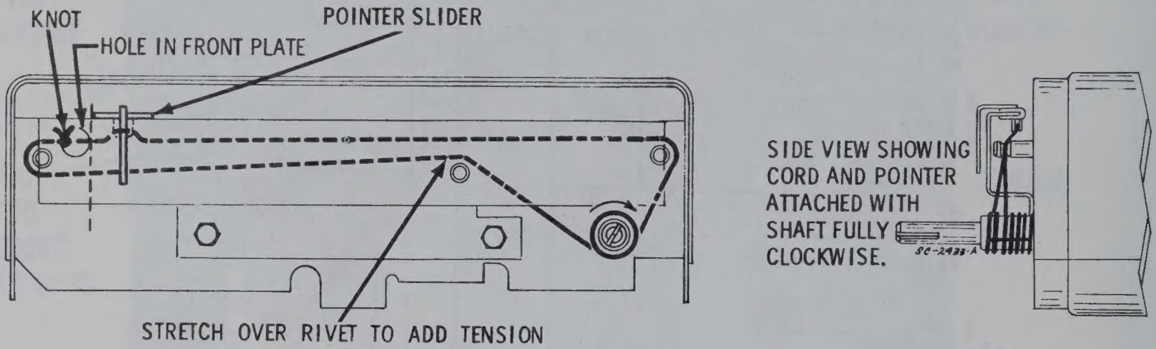
IF FREQ-10.7MC

SCHEMATIC DIAGRAM


1/4" MAX
KNOT & CEMENT
B
A
HOLE
1 TURN MIN
B
A
6 TURNS MIN
TUNING SHAFT
HOLE

TURN TUNING SHAFT FULLY COUNTERCLOCKWISE BEFORE STARTING RESTRINGING.

STEP 1

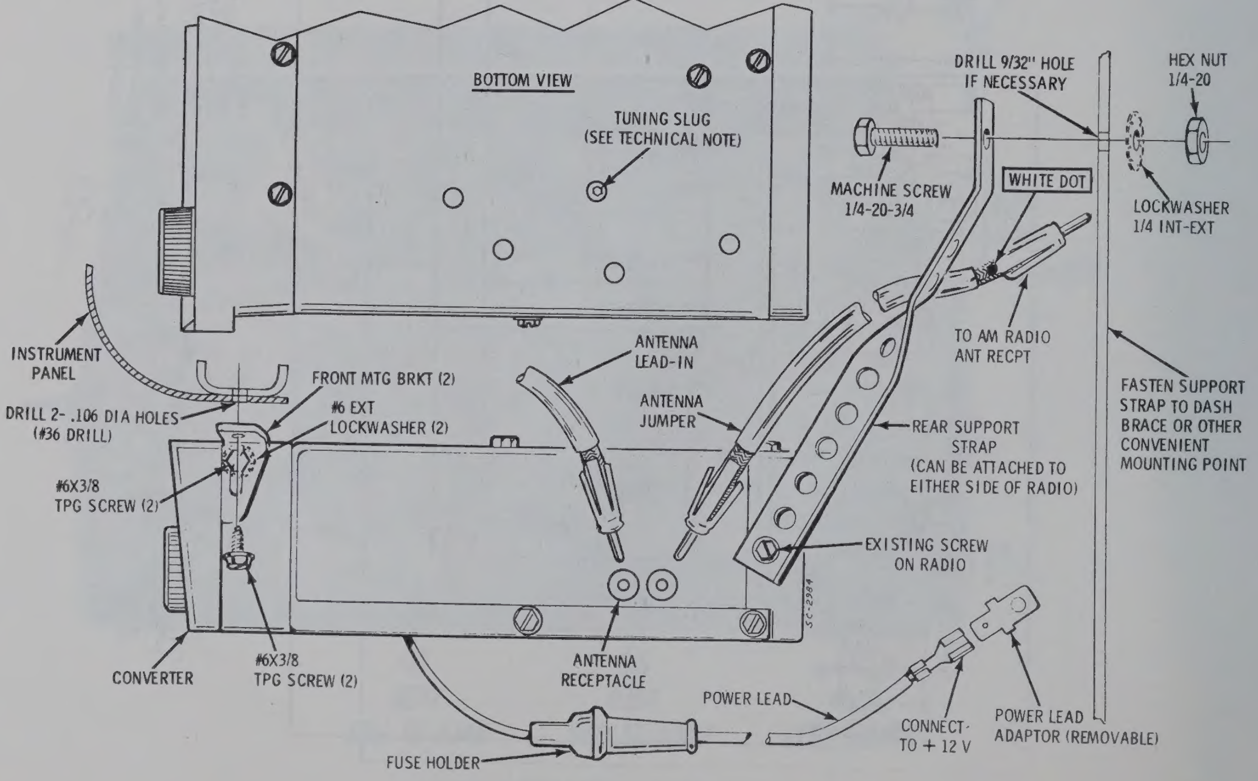

KNOT
HOLE IN FRONT PLATE
POINTER SLIDER
STRETCH OVER RIVET TO ADD TENSION
SC-2435-A

SIDE VIEW SHOWING CORD AND POINTER ATTACHED WITH SHAFT FULLY CLOCKWISE.

TURN TUNING SHAFT FULLY COUNTER-CLOCKWISE. PLACE LEFT SLIDER EDGE AT RIGHT EDGE OF HOLE. ATTACH CORD. BEND CENTER TAB UP AND CEMENT POINTER SLIDER IN PLACE.

STEP 2

DIAL STRINGING DETAIL


BOTTOM VIEW
TUNING SLUG
(SEE TECHNICAL NOTE)
DRILL 9/32" HOLE IF NECESSARY
HEX NUT 1/4-20
MACHINE SCREW 1/4-20-3/4
WHITE DOT
LOCKWASHER 1/4 INT-EXT
TO AM RADIO ANT RECPT
FASTEN SUPPORT STRAP TO DASH BRACE OR OTHER CONVENIENT MOUNTING POINT
INSTRUMENT PANEL
ANTENNA LEAD-IN
FRONT MTG BRKT (2)
DRILL 2- .106 DIA HOLES (#36 DRILL)
#6 EXT LOCKWASHER (2)
ANTENNA JUMPER
REAR SUPPORT STRAP (CAN BE ATTACHED TO EITHER SIDE OF RADIO)
#6X3/8 TPG SCREW (2)
EXISTING SCREW ON RADIO
SC-2384
CONVERTER
#6X3/8 TPG SCREW (2)
ANTENNA RECEPTACLE
POWER LEAD
CONNECT TO + 12 V
POWER LEAD ADAPTOR (REMOVABLE)
FUSE HOLDER

TYPICAL INSTALLATION

REPLACEMENT PARTS LIST

Ref. No.	Part Number	Description
		ELECTRICAL PARTS
CAPACITORS - NOTE:		The capacitors in this list are recommended replacement types for the original equipment; all are ceramic disc type unless otherwise specified.
C-1 thru C-25	---	PART OF FM TUNER
C-26	21S135234	.01 mf +80-20% 100V (USE 21S132103)
C-27	21S135234	.01 mf +80-20% 100V (USE 21S132103)
C-28	21S135234	.01 mf +80-20% 100V (USE 21S132103)
C-29	21S135234	.01 mf +80-20% 100V (USE 21S132103)
C-30	21S135234	.01 mf +80-20% 100V (USE 21S132103)
C-31	23S187A13	125 mf 16V lytic
C-32	21S135234	.01 mf +80-20% 100V (USE 21S132103)
C-33	21S135234	.01 mf +80-20% 100V (USE 21S132103)
C-34	21S135234	.01 mf +80-20% 100V (USE 21S132103)
C-35	21S135234	.01 mf +80-20% 100V (USE 21S132103)
C-36	21S180A57	.05 mf +80-20% 100V (USE 21S132524)
C-37	21S127090	330 pf 10% 500V
C-38	21S127090	330 pf 10% 500V
C-39	21S127090	330 pf 10% 500V
C-40	23S187A01	6.4 mf 40V lytic
C-41	21S135234	.01 mf +80-20% 100V (USE 21S132103)
C-42	21S132350	.0015 mf 10% 500V
C-43	23S187A09	640 mf 16V lytic (USE 23C41928A27)
C-44	21S135234	.01 mf +80-20% 100V (USE 21S132103)
C-45	21S115953	3.9 pf 10% 500V FC
C-46	21S180A79	56 pf 5% 500V NPO
C-47	21S135234	.01 mf +80-20% 100V (USE 21S132103)
C-48	21A560232	FEED-THRU
C-49	8S131799	.01 mf 20% 100V mylar (USE 8K131587)
C-50	8S131799	.01 mf 20% 100V mylar (USE 8K131587)
C-51	21S10003A01	.47 mf +100-0% 3V
C-52	21S135234	.01 mf +80-20% 100V (USE 21S132103)
C-53	21S135234	.01 mf +80-20% 100V (USE 21S132103)
C-54	21S135234	.01 mf +80-20% 100V (USE 21S132103)
MISCELLANEOUS ELECTRICAL PARTS		
E-1	---	PART OF FM TUNER
E-2, E-3	---	PART OF T4
E-4	48A40458A06	DIODE, zener: 1N756A
E-5	65R538410	BULB, dial: 14.4V - .11A
E-6	65S122345	FUSE, 5 amp: 32V; 1AG5
S-1	40B64745A01	SWITCH, on-off
COILS & TRANSFORMERS		
L-1 thru L-10	---	PART OF FM TUNER

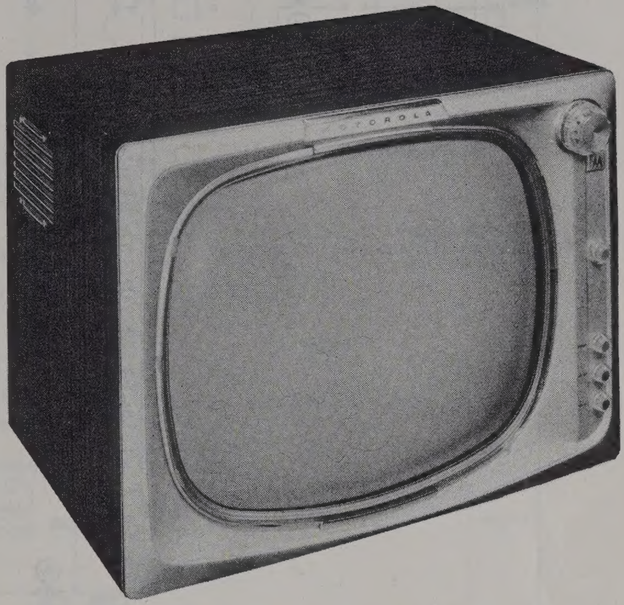
Ref. No.	Part Number	Description
L-11, L-12	24C64003B01	CHOKE
T-1	24C64104A01	1st IF: 10.7MC
T-2	24C64104A01	2nd IF: 10.7MC
T-3	24C64104A01	3rd IF: 10.7MC
T-4	24D64391A01	RATIO DETECTOR
T-5	24C63348A01	OSCILLATOR
T-6	---	PART OF FM TUNER
TRANSISTORS		
Q-1	48P64978A27	T1400
Q-2	48P64978A28	T1401
Q-3	48P64978A29	T1387
Q-4	48S134857	4857
Q-5	48S134857	4857
Q-6	48S134857	4857
Q-7	48S134857	4857
Q-8	48S134805	25B
		MECHANICAL PARTS
	64B64752A01	BACKGROUND, dial
	42B485548	CLIP, coil shield mtg
	15E64148B04	COVER, back
	15E64148B07	COVER, bottom
	13D64741A01	ESCUTCHEON, dial
	44B64222A01	GEAR, hub: w/1/4" DIA. hole (FM tuner shaft)
	44B64221A01	GEAR, idler: w/1/2 dia hole (FM tuner shaft)
	36B543847	KNOB, on-off & tuning
	29K534326	LUG, term: fuse recept
	2S7051	NUT, pal: 3/8-32 (sw mtg)
	2S10101A29	NUT, speed: dial ret
	28A533126	PLUG, shorting
	52A64744A01	POINTER, dial
	9A531066	RECEPTACLE, ant
	1V64964A32	RECEPTACLE, fuse: compl
	9A61112A01	RECEPTACLE, test: 4-pin
	34B64198A01	SCALE, dial
	3A563128	SCREW, set: 4-40 x 5/16 (gear hub mtg)
	47A64206A01	SHAFT, tuning: incl gear & pin
	9K544615	SOCKET, dial light (USE 9A562925)
	41A64207A01	SPRING, anti-backlash: hub & idler gears
	41B536529	SPRING, shaft ret: tuning shaft
	42K485718	STRAP, radio mtg
	*77D64112A01	TUNER, FM: compl
	4A64153A01	WASHER, shaft stabilizer
	4A64214A01	WASHER, stop: tuning shaft
		INSTALLATION PARTS
	1V64950A12	RADIO INSTALLATION KIT
	45K538873	ARM, adaptor: fuse recept
	7A544384	BRACKET, radio mtg: LH
	7K544386	BRACKET, radio mtg: RH
	1B64892A01	CABLE, ant jumper
	2S2878	NUT, hex: 1/4-20 (radio mtg)
	29K580544	PLUG, ant jumper cable
	3S6990	SCREW, mach: 1/4-20 x 3/4 (radio mtg)
	3S131448	SCREW, mach: 6-20 x 3/8 (brkt mtg)

*DENOTES NEW ITEM APPEARING IN ANY LIST FOR FIRST TIME.

DISASSEMBLY INSTRUCTIONS

CABINET REMOVAL

1. Remove 1 metal screw above AC interlock. Pry off rear cover.
2. Unplug 2 speaker plugs.
3. Remove 2 metal screws holding rear mounting bracket.
4. Remove safety glass is outlined under "Safety Glass Cleaning".
5. Remove 2 chassis bolts from beneath safety glass retainer.
6. Remove 6 cabinet bolts from bottom of cabinet.
7. Remove cabinet.
8. Remove 4 speaker nuts. Remove speaker.



MODEL	CHASSIS
21T32MGA	TS-537

MOTOROLA MODELS Y21K53B, BA, M, MA, Y21K55B, BA, M, MA, Y21T32B, BA, CH, CHA, MGA, Y21T34B, BA, M, MA, Y24K13B, M, Y24T5BG, MG, 21K35B, BA, M, MA, 21K55B, BA, M, MA, 21T32B, BA, CH, CHA, MGA, 21T34B, BA, M, MA, 24K13B, M, 24T5BG, MG (Ch. TS-537, Y, TTS-537, Y, WTS-537, Y)

SERVICING IN THE FIELD

TUNER OSCILLATOR ADJUSTMENTS

Touch-up adjustments of the VHF tuner oscillator circuit may be accomplished by removing the channel selector and fine tuning knobs.

TUNER SERVICE

The VHF section of the tuner may be serviced by removing 1 screw and 2 springs, removing the shaft and uplugging the wafer sections. This will provide access to the parts for replacement .

PICTURE TUBE SAFETY GLASS CLEANING

Remove "snap on" name plate. Remove 2 metal screws. Remove safety glass retainer. Use extreme caution in removing safety glass.

SERVICE ADJUSTMENT LOCATION

See tube placement chart on page 11.

HORIZONTAL OSCILLATOR FIELD ADJUSTMENT

Adjustment of the horizontal oscillator may be made from the rear panel of the chassis. Set the horizontal hold control to its mid-range position and adjust the horizontal frequency slug (B1) until the picture synchronizes horizontally.

FUSES

A 7.5Ω fusible resistor (R113) is used for LV power supply protection.

CENTERING

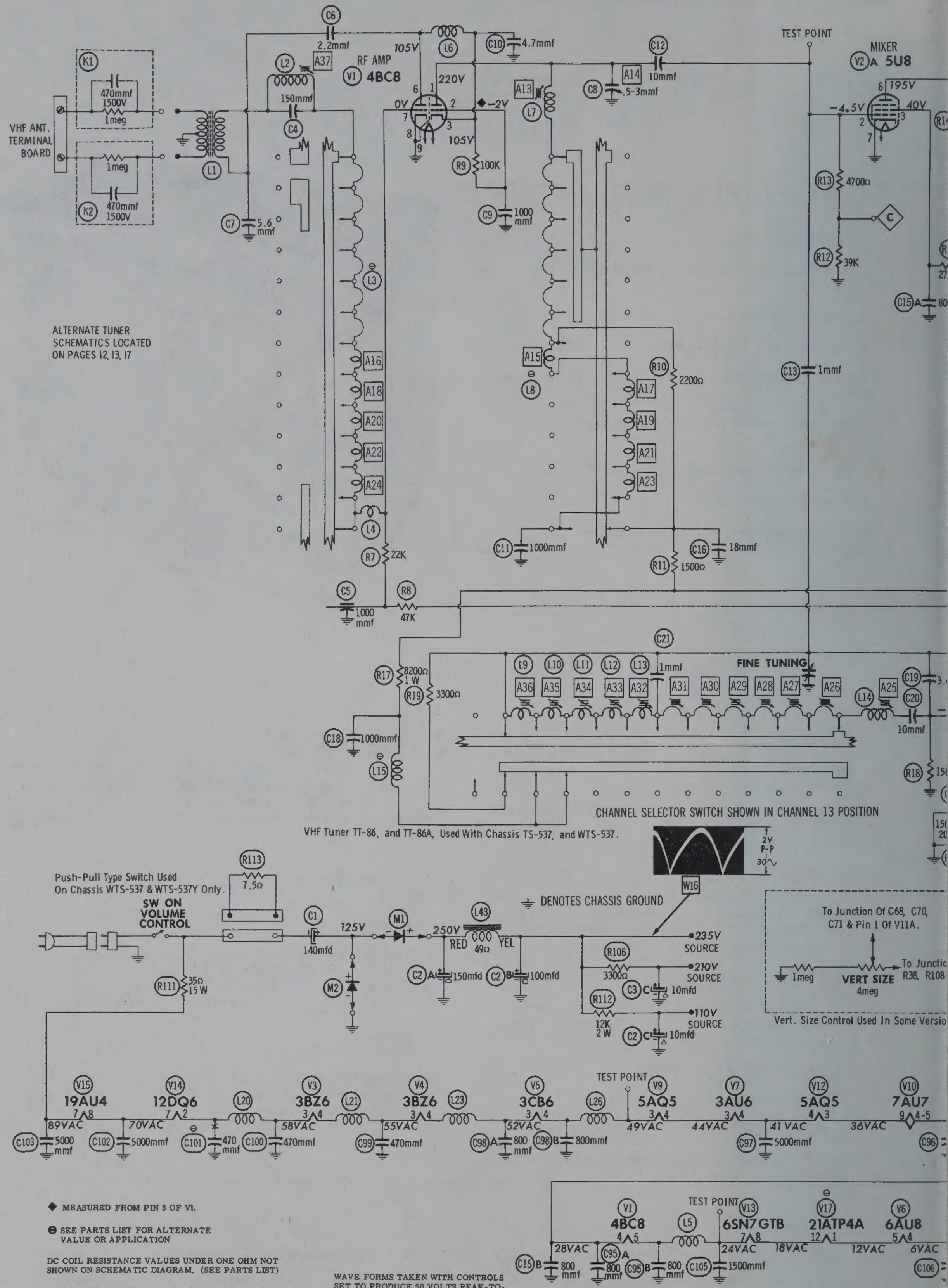
Centering is accomplished mechanically by adjusting two magnetic rings around the neck of the picture tube, located flush against the deflection yoke. Rotate the two rings around the neck of the tube until the picture is properly centered.

ANTI-PIN CUSHION CORRECTION

Reduce picture width until sides of raster are visible. Position magnets (M10 and M11) until sides are straight. Readjust width to fill screen.

HOWARD W. SAMS & CO., INC. • Indianapolis 5, Indiana

"The listing of any available replacement part herein does not constitute in any case a recommendation, warranty or guaranty by Howard W. Sams & Co., Inc., as to the quality and suitability of such replacement part. The numbers of these parts have been compiled from information furnished to Howard W. Sams & Co., Inc., by the manufacturers of the particular type of replacement part listed." "Reproduction or use, without express permission, of editorial or pictorial content, in any manner, is prohibited. No patent liability is assumed with respect to the use of the information contained herein. Copyright 1957 by Howard W. Sams & Co., Inc., Indianapolis 5, Indiana, U. S. of America. Copyright under international Copyright Union. All rights reserved under Inter-American Copyright Union (1910) by Howard W. Sams & Co., Inc." Printed in U. S. of America


VHF ANT. TERMINAL BOARD
K1
470mmf 1500V
1meg
1meg
470mmf 1500V
K2
L1
C7 5.6 mmf
C6 2.2mmf
L2
A37
150mmf
C4
RF AMP
V1 4BC8
105V
220V
0V
-2V
105V
L6
C10 4.7mmf
C12 10mmf
A14
C8 .5-3mmf
A13
L7
R9 100K
C9 1000 mmf
L3
A16
A18
A20
A22
A24
L4
R7 22K
C5 1000 mmf
R8 47K
A15
L8
R10 2200Ω
A17
A19
A21
A23
C11 1000mmf
C16 18mmf
R11 1500Ω
TEST POINT
MIXER
V2A 5U8
195V
-4.5V
40V
R13 4700Ω
C
R12 39K
C15A
C13 1mmf
ALTERNATE TUNER SCHEMATICS LOCATED ON PAGES 12, 13, 17
C21 1mmf
FINE TUNING
L9 L10 L11 L12 L13
A36 A35 A34 A33 A32 A31 A30 A29 A28 A27 A26 A25
L14
C19
C20
10mmf
R17 8200Ω 1 W
R19 3300Ω
C18 1000mmf
L15
R18
CHANNEL SELECTOR SWITCH SHOWN IN CHANNEL 13 POSITION
VHF Tuner TT-86, and TT-86A, Used With Chassis TS-537, and WTS-537.
2V P-P 30∿
W16
DENOTES CHASSIS GROUND
Push-Pull Type Switch Used On Chassis WTS-537 & WTS-537Y Only.
R113 7.5Ω
SW ON VOLUME CONTROL
C1 140mfd
125V
M1
250V
L43
RED 49Ω YEL
235V SOURCE
R106 3300Ω
210V SOURCE
C3C 10mfd
R111 35Ω 15 W
M2
C2A 150mfd
C2B 100mfd
R112 12K 2 W
110V SOURCE
C2C 10mfd
To Junction Of C68, C70, C71 & Pin 1 Of V11A.
1meg
VERT SIZE 4meg
To Junctio R38, R108
Vert. Size Control Used In Some Versio
TEST POINT
V15 19AU4 7 8
V14 12DQ6 7 2
L20
V3 3BZ6 3 4
L21
V4 3BZ6 3 4
L23
V5 3CB6 3 4
L26
V9 5AQ5 3 4
V7 3AU6 3 4
V12 5AQ5 4 3
V10 7AU7 9 4-5
89VAC
70VAC
58VAC
55VAC
52VAC
49VAC
44VAC
41 VAC
36VAC
C103 5000 mmf
C102 5000mmf
C101 470 mmf
C100 470mmf
C99 470mmf
C98A 800 mmf
C98B 800mmf
C97 5000mmf
C96
TEST POINT
V1 4BC8 4 5
L5
V13 6SN7GTB 7 8
V17 21ATP4A 12 1
V6 6AU8 5 4
28VAC
24VAC
18VAC
12VAC
6VAC
C15B 800 mmf
C95A 800 mmf
C95B 800 mmf
C105 1500mmf
C106

◆ MEASURED FROM PIN 3 OF V1.

⊖ SEE PARTS LIST FOR ALTERNATE VALUE OR APPLICATION

DC COIL RESISTANCE VALUES UNDER ONE OHM NOT SHOWN ON SCHEMATIC DIAGRAM. (SEE PARTS LIST)

ARROWS ON CONTROLS INDICATE CLOCKWISE ROTATION (CONTROL VIEWED FROM SHAFT END)

WAVE FORMS TAKEN WITH CONTROLS SET TO PRODUCE 50 VOLTS PEAK-TO-PEAK SIGNAL AT PICTURE TUBE

1. DC voltage measurements are at 20,000 ohms per volt; AC voltage measured at 1,000 ohms per volt.
2. Pin numbers are counted in a clockwise direction on bottom of socket.
3. Measured values are from socket pin to common negative unless otherwise stated.
4. Line voltage maintained at 117 volts for voltage readings.
5. All controls set for normal operation; No signal applied.

A PHOTOFACT STANDARD NOTATION SCHEMATIC

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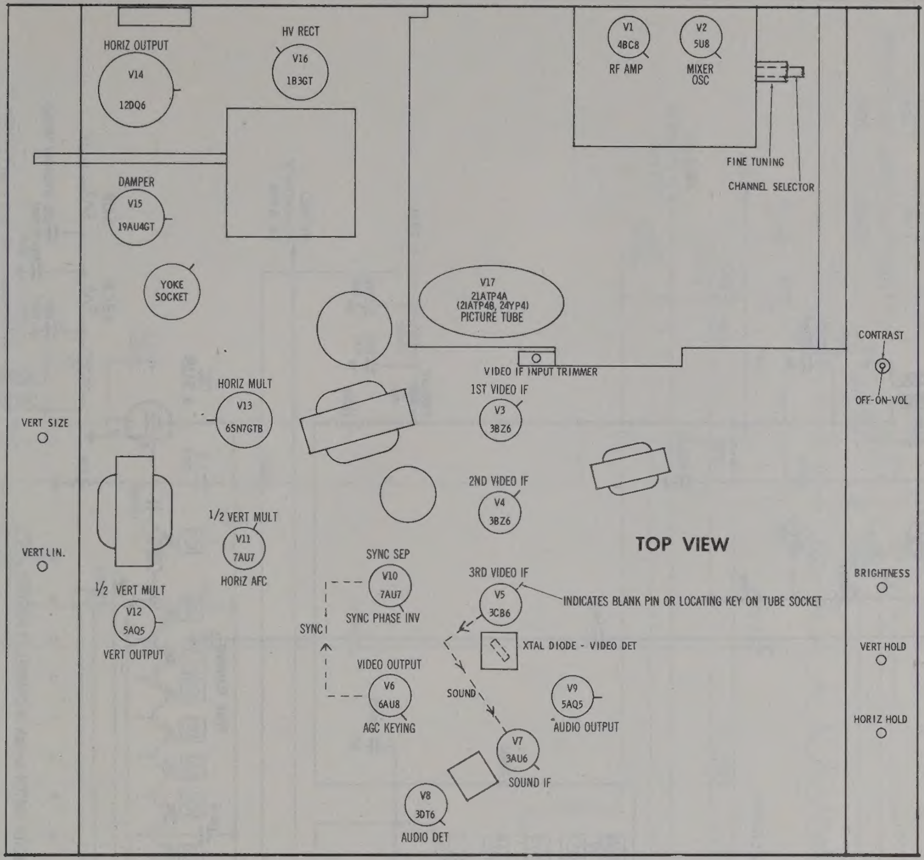
TUBE PLACEMENT CHART


HORIZ OUTPUT
V14
12DQ6
HV RECT
V16
1B3GT
V1
4BC8
RF AMP
V2
5U8
MIXER OSC
FINE TUNING
CHANNEL SELECTOR
DAMPER
V15
19AU4GT
YOKE SOCKET
V17
21ATP4A
(21ATP4B, 24YP4)
PICTURE TUBE
CONTRAST
OFF-ON-VOL
VIDEO IF INPUT TRIMMER
1ST VIDEO IF
V3
3BZ6
HORIZ MULT
V13
6SN7GTB
VERT SIZE
2ND VIDEO IF
V4
3BZ6
1/2 VERT MULT
V11
7AU7
HORIZ AFC
TOP VIEW
VERT LIN.
SYNC SEP
V10
7AU7
SYNC PHASE INV
3RD VIDEO IF
V5
3CB6
INDICATES BLANK PIN OR LOCATING KEY ON TUBE SOCKET
BRIGHTNESS
1/2 VERT MULT
V12
5AQ5
VERT OUTPUT
SYNC
XTAL DIODE - VIDEO DET
VERT HOLD
VIDEO OUTPUT
V6
6AU8
AGC KEYING
SOUND
V9
5AQ5
AUDIO OUTPUT
HORIZ HOLD
V7
3AU6
SOUND IF
V8
3DT6
AUDIO DET

TUBE FAILURE CHECK CHART

The following chart lists tubes whose failures are most likely to produce the indicated symptoms. Refer to tube placement chart for location and type of tube.

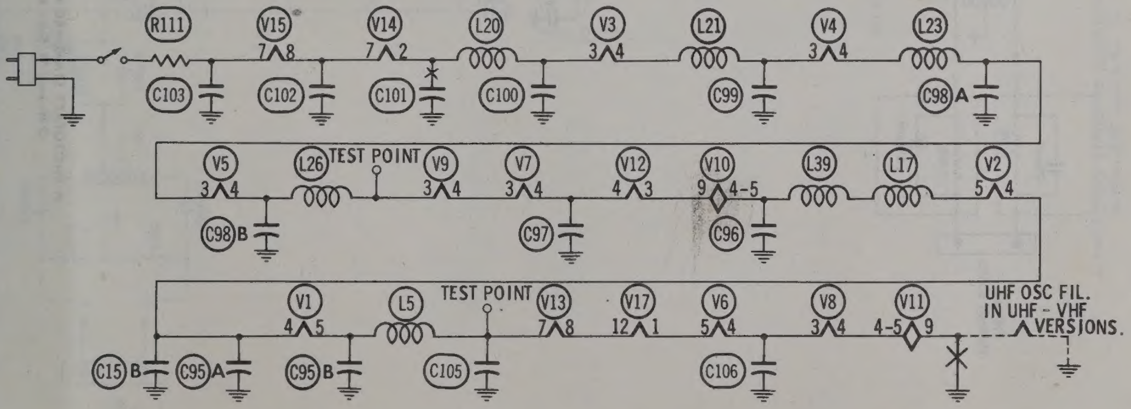
POWER SUPPLY FAILURE
No raster, no sound - Fusible Resistor (R113), Rectifier (M1), (M2)

LOSS OF PICTURE OR SOUND
No pic, no sound, has raster - V3, V4, V5, Diode (M3), V6, V17
No pic, no sound, has snow - V1, V2, V3
No pic, has sound, has raster - V6, V17
Has pic, no sound - V7, V8, V9
Overloaded picture - V6

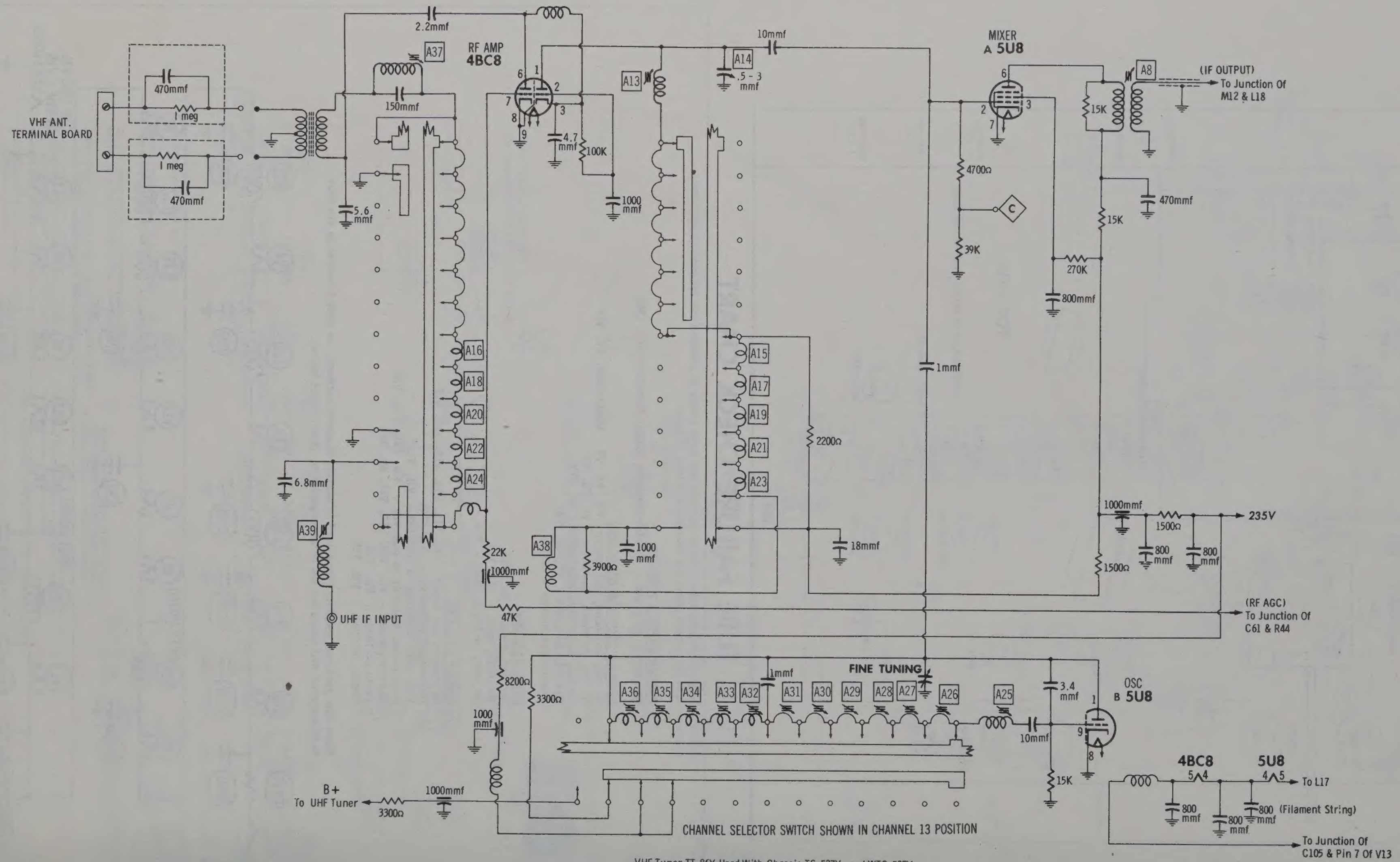
SYNC FAILURE
No vert. sync - V11, V12
No horiz. sync - V11, V13
No vert. or horiz. sync - V10

SWEEP FAILURE
No raster, has sound - V11, V13, V14, V15, V16, V17
No vertical deflection - V11, V12
Poor vert. linearity or foldover - V11, V12
Poor horiz. linearity or foldover - V11, V13, V14, V15
Narrow picture - V11, V13, V14, V15, M1, M2
Vert. off freq. - V11, V12
Horiz. off freq. - V11, V13

Since this receiver employs tubes used in series, filament network, an open filament in any tube in this series will cause the set to be inoperative. (See circuit below).


R111
V15
7 8
V14
7 2
L20
V3
3 4
L21
V4
3 4
L23
C103
C102
C101
C100
C99
C98 A
V5
3 4
L26
TEST POINT
V9
3 4
V7
3 4
V12
4 3
V10
9 4-5
L39
L17
V2
5 4
C98 B
C97
C96
V1
4 5
L5
TEST POINT
V13
7 8
V17
12 1
V6
5 4
V8
3 4
V11
4-5 9
UHF OSC FIL.
IN UHF - VHF
VERSIONS.
C15 B
C95 A
C95 B
C105
C106

MOTOROLA MODELS Y21K53B, BA, M, MA, Y21K55B, BA, M, MA, Y21T32B, BA, CH, CHA, MGA, Y21T34B, BA, M, MA, Y24K13B, M, Y24T5BG, MG, 21K35B, BA, M, MA, 21K55B, BA, M, MA, 21T32B, BA, CH, CHA, MGA, 21T34B, BA, M, MA, 24K13B, M, 24T5BG, MG (Ch. TS-537, Y, TTS-537, Y, WTS-537, Y)


VHF ANT.
TERMINAL BOARD
470mmf
1 meg
1 meg
470mmf
2.2mmf
A37
150mmf
5.6 mmf
RF AMP
4BC8
1
2
3
6
7
8
9
4.7 mmf
100K
1000 mmf
A13
A14
.5 - 3 mmf
10mmf
MIXER
A 5U8
6
2
3
7
A8
15K
(IF OUTPUT)
To Junction Of
M12 & L18
4700Ω
C
39K
470mmf
15K
270K
800mmf
1mmf
A15
A17
A19
A21
A23
2200Ω
18mmf
A16
A18
A20
A22
A24
6.8mmf
A39
UHF IF INPUT
22K
1000mmf
47K
A38
3900Ω
1000 mmf
1000mmf
1500Ω
800 mmf
800 mmf
1500Ω
235V
(RF AGC)
To Junction Of
C61 & R44
FINE TUNING
1mmf
A36
A35
A34
A33
A32
A31
A30
A29
A28
A27
A26
A25
3.4 mmf
10mmf
15K
OSC
B 5U8
1
9
8
8200Ω
3300Ω
1000 mmf
B+
To UHF Tuner
3300Ω
1000mmf
4BC8
5
4
5U8
4
5
To L17
800 mmf
800 mmf
800 mmf
(Filament String)
To Junction Of
C105 & Pin 7 Of V13
CHANNEL SELECTOR SWITCH SHOWN IN CHANNEL 13 POSITION

VHF Tuner TT-86Y Used With Chassis TS-537Y, and WTS-537Y.

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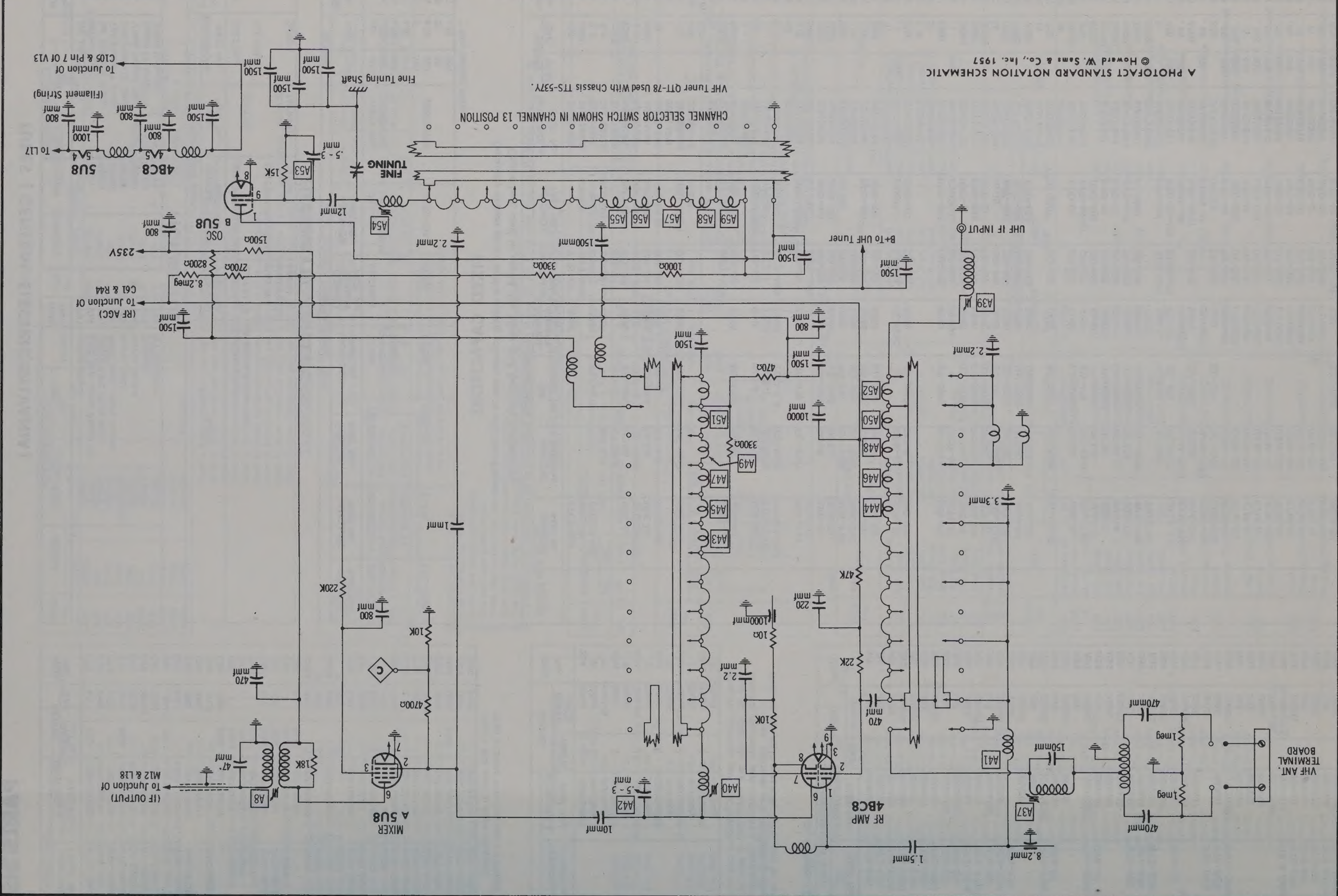
ALTERNATE VHF TUNER

ALTERNATE VHF TUNER


VHF ANT. TERMINAL BOARD
1meg
1meg
470mmf
470mmf
150mmf
A37
8.2mmf
A41
1.5mmf
RF AMP
4BC8
1
2
3
6
7
8
9
10K
2.2 mmf
10Ω
1000mmf
22K
220 mmf
47K
10000 mmf
470 mmf
A40
A42
.5 - 3 mmf
10mmf
A43
A44
A45
A46
A47
A48
A49
3300Ω
A50
A51
A52
470Ω
1500 mmf
800 mmf
1500 mmf
3.3mmf
2.2mmf
A39
UHF IF INPUT
B+To UHF Tuner
1500 mmf
MIXER
A 5U8
4700Ω
10K
C
800 mmf
220K
1mmf
470 mmf
18K
A8
47 mmf
(IF OUTPUT) To Junction Of M12 & L18
2.2mmf
1500mmf
3300Ω
1000Ω
A55
A56
A57
A58
A59
1500 mmf
(RF AGC) To Junction Of C61 & R44
1500 mmf
8.2meg
8200Ω
2700Ω
1500Ω
235V
800 mmf
OSC
B 5U8
A54
FINE TUNING
12mmf
A53
.5 - 3 mmf
15K
Fine Tuning Shaft
1500 mmf
1500 mmf
1500 mmf
4BC8
5U8
4
5
1500 mmf
800 mmf
800 mmf
1000 mmf
800 mmf
To L17
(Filament String)
To Junction Of C105 & Pin 7 Of V13

CHANNEL SELECTOR SWITCH SHOWN IN CHANNEL 13 POSITION

VHF Tuner QTT-78 Used With Chassis TTS-537Y.

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TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES
V1	RF Amp.	4BC8	
V2	Mixer-Osc.	5U8	
V3	1st Video IF Amp.	3BZ6	
V4	2nd Video IF Amp.	3BZ6	
V5	3rd Video IF Amp.	3CB6	
V6	Video Output-AGC Keying	6AU8	
V7	Sound IF Amp.	3AU6	
V8	Audio Detector	3DT6	

ITEM No.	USE	TYPE	NOTES
V9	Audio Output	5AQ5	
V10	Sync Sep. -Sync Phase Inv.	7AU7	
V11	Horiz. AFC-Vert. Mult.	7AU7	
V12	Vert. Mult. -Vert. Output	5AQ5	
V13	Horiz. Mult.	6SN7GTB	
V14	Horiz. Output	12DQ6	
V15	Damper	19AU4	
V16	HV Rectifier	1B3GT	

PICTURE TUBE

ITEM No.	REPLACEMENT DATA				NOTES
	MOTOROLA PART No.	CBS PART No.	GENERAL ELECTRIC PART No.	SYLVANIA PART No.	
V17	21ATP4A		21ATP4A/21ATP4①	21ATP4A	① Aluminized
		21ATP4		21ATP4 ②	② Silver Screen "85"
	21ATP4B				
			21ATP4A/21ATP4①	21ATP4A	
		21ATP4		21ATP4 ②	
	24YP4	24YP4 ①	24YP4 ①	24YP4 ②	

ELECTROLYTIC CAPACITORS

ITEM No.	RATING		REPLACEMENT DATA						
	CAP.	VOLT.	PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	SPRAGUE PART No.
C1	140	150	23B737630	PR1-100	BRE15015	TC495	TD-150-150	MT-15150	TVA-1422
C2A	▲150	300	23B738749	AFHS4-02-75		FP333. 9			R2343*
B	■100	300				WS427			
C	▲10	300							
D	5	300							
C3A	■30	300	23B738750	AFH3-108	CO810	FP330. 7	TMT-93	T-475	TVL-3635. 5
B	20	25							
C	▲10	300							

* Non catalog item.

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING		REPLACEMENT DATA							NOTES
	CAP.	VOLT	MOTOROLA PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	
C4	150		21R124608		TCN-150	N046	TC7-150		5TCU-T15	
C5	1000		21A739920	EF-001	MFT-1000				503C-D1	
C6	2. 2		21K115948	NP0-SI2. 2	D6-030	TP05	TCO-2. 2		5TCCB-V22	
C7	5. 6		21A732738	NP0-DI5	DD-050	G011		ZT-555		
C8	. 5-3		21K735985		829-3		3139-D	CT565A		
C9	1000		21R115386	BPD-001	DD-102	K069	ED-1000	DC521	5HK-D1	
C10	4. 7		21R115954	NP0-SI4. 7	TCZ-4R7	G011	TCO-4. 7	ZT-5547	5TCCB-V47	
C11	1000		21R115386	BPD-001	DD-102	K069	ED-1000	DC521	5HK-D1	
C12	10		21R124579	NP0-DI 10	DD-100	Z018	ED-10	ZT-541	5TCC-Q1	
C13	1		21R11 4071							
C14	470		21R114554	BPD-00047	DD-471	K060	ED-470	UC-5347	5GA-T47	
C15A	800		21R400943	SI 820						
B	800									
C16	18		21R120578							
C17	1000		21A739920	EF-001	MFT-1000				503C-D1	
C18	1000		21R115386	BPD-001	DD-102	K069	ED-1000	DC521	5HK-D1	
C19	3. 4		21R124489							
C30	10		21R121877	BPD-000010	DD-100	G018	ED-10	UC-541	5GA-Q1	
C21	1		21R124552	NP0-SI 1	TCZ-1	TZ03	TCO-1	ZT-5675	5TCCB-V1	
C22	3. 3		21R115954	NP0-SI3. 3	TCZ-3R3	TP05	TCO-3. 3	ZT-5533	5TCCB-V33	
C23	22		21R119896							
C24	470		21R114554	BPD-00047	DD-471	K060	ED-470	UC-5347	5GA-T47	
C25	1000		21A737426	EF-001	MFT-1000				503C-D1	
C26	1000		21R115386	BPD-001	DD-102	K069	ED-1000	DC521	5HK-D1	
C27	1000		21R114554	BPD-001	DD-102	K069	ED-1000	DC521	5HK-D1	Note 2
C28	560		21R120936	DI-560	DD-561	G063	ED-560	UC-5356	5GA-T56	
C29	470		21R114554		DD-471	K060	ED-470	UC-5347	5GA-T47	Note 1
C30	1000		21R115386	BPD-001	DD-102	K069	ED-1000	DC521	5HK-D1	
C31	1000		21R115386	BPD-001	DD-102	K069	ED-1000	DC521	5HK-D1	
C32	47		21R115593							
C33	.1	200	8R121573	P288N-1	DF-104	CUB2W1		GEM-201	2TM-P1	
C34	1000		21R115386	BPD-001	DD-102	K069	ED-1000	DC521	5HK-D1	
C35	3. 9		21R115953							
C36	27		21R119896							
C37	5000		21R115312	BPD-005	DD-502	K080	GP-5000	DC525	5HK-D5	
C38	.1	400	8R121006	P488N-1	DF-104	ST4W1		GEM-401	4TM-P1	
C39	10000		21R482726	BPD-01	DD-103	K082	GP-10000	DC511	5HK-S1	
C40	5000		21R120093	BPD-005	DD-502	K080	GP-5000	DC525	5HK-D5	
C41	10000		21R122789	BPD-01	DD-103	K082	GP-10000	DC511	5HK-S1	
C42	18		21R120578	DI-18	DD-200	G022	ED-18	UC-5418	5GA-Q18	
C43	5000		21A738298	BPD-005	DD-503	K080	GP-5000	DC525	5HK-D5	
C44	5000		21A738298	BPD-005	DD-502	K080	GP-5000	DC525	5GA-D5	
C45	5000		21A738298	BPD-005	DD-502	K080	GP-5000	DC525	5GA-D5	
C46	18		21A120578							
C47	220		21R122420	DI-220	DD-221	G051	ED-220	UC-5322	5GA-T22	
C48	18		21R120578							
C49	10000		21R121478	BPD-01	DD-103	K082	GP-10000	DC511	5HK-S1	
C50	470		21R124674	BPD-00047	DD-471	K060	ED-470	UC-5347	5GA-T47	
C51	5000			BPD-005	DD-502	K080	GP-5000	DC525	5GA-D5	
C52	10000		21R115321	BPD-01	DD-103	K082	GP-10000	DC511	5HK-S1	
C53	10000		21R121946	BPD-01	DD-103	K082	GP-1000	DC511	5HK-S1	
C54	5000		21A738298	BPD-005	DD-502	K080	GP-5000	DC525	5GA-D5	
C55	3300		21R120422	DI-3300	DD-332	K077	GP-3300	UC-5233	5HK-D25	
C56	5000	2000	21A738298			V2D5			20HK-D5	
C57	5		21R124452	NP0-SI5	TCZ-4R7	Z011	TCO-5	ZT-555		
C58	470	2000	21R114554	HVD-30-470	DD30-471	V2T47	ED-470	DC30347	20GA-T47	
C59	. 25	100	8K122045	P188N-25		CUB2P25		GEM-2025	2TM-P25	
C60	4700		21R120149	BPD-0047	DD-472	K079	GP-4700	DC525	5GA-D47	
C61	. 25	100	8K122045	P188N-25		CUB2P5		GEM-2025	2TM-P25	
C62	220		21K122420	DI-220	DD-221	G051	ED-220	UC-5322	5HK-D22	
C63	. 05	400	8R121567	BPD-05	DF-503	CUB4S5		GEM-415	4TM-S5	
C64	. 002	600	8R121568	BPD-002	D6-202	CUB6D2		GEM-622	6TM-D2	
C65	. 01	400	8K739259	BPD-01	D6-103	CUB4S1		GEM-411	4TM-S1	
C66	. 003	600	8R121569	BPD-003	D6-302	CUB6D3		GEM-623	6TM-D3	
C67	. 015	400	8K737422	BPD-015	D6-103	CUB4S1		GEM-411	4TM-S15	
C68	. 05	600	8R122288	BPD-05	DF-503	CUB6S5		GEM-615	6TM-S5	
C69	. 05	200	8R121005	BPD-05	DF-503	CUB2S5		GEM-415	2TM-S5	
C70	. 02	200	8R122079	BPD-02	DF-203	CUB2S2		GEM-412	2TM-S2	
C71	. 01	600	8R122288	BPD-01	D6-103	CUB6S1		GEM-611	6TM-S1	
C72	. 03	600	8R122262	BPD-03	DF-303	CUB6S3		GEM-613	6TM-S3	
C73	1000	2000	21R124541	HVD-30-1000	DD30-102	V2D1	HD3-1000	DC3021	20GA-D1	

PARTS LIST AN

CAPACI

ITEM No.	RATING		MOTOROLA PART No.	AEROVOX PART No.	CENTRALA PART No.
	CAP.	VOLT			
C74	47		21R122822	N750-SI47	TCN-47
C75	1000		21A121678	1464-001	DD-102
C76	470		21R144554	1464-000047	DD-471
C77	1000	2000	21R124456	HVD-30-1000	DD30-102
C78	3300		21R120422	DI-3300	DD-332
C79	10000		21R482726	DI-10000	DD-103
C80	3300		21R120422	DI-3300	DD-332
C81	. 0047	400	8K734634	BPD-0047	D6-472
C82	100		21R400537	N750-SI 100	TCN-100
C83	680		21K736046	1464-00068	D6-681
C84	390		21B735757		D6-391
C85	5000		21R115312	BPD-005	DD-502
C86	5000	2000	21R738298		
C87	.1	400	8K121006	P488N-1	DF-104
C88	.1	600	8K121869	P688N-1	DF-104
C89	.1	600	8K121869	P688N-1	DF-104
C90	150	2000	21R122914	HVD-30-1500	DD30-151
C91	150	2000	21R122914	HVD-30-1500	DD30-151
C92	.1	200	8R121573	P288N-1	DF-104
C93	82	2000	21R120150		DD30-820
C94A	800		21R400943	SI820	DD-801
B	800			SI820	DD-801
C95A	800		21R400943	SI820	DD-801
B	800			SI820	DD-801
C96	470		21R114554	BPD-00047	
C97	5000		21R115312	BPD-005	
C98A	800		21R400943	SI820	DD-801
B	800			SI820	DD-801
C99	470		21R114554	BPD-00047	DD-471
C100	470		21R121797	BPD-00047	DD-471
C101	470		21R121797	BPD-00047	DD-471
C102	5000		21R120093	BPD-005	DD-502
C103	5000		21R120093	BPD-005	DD-502
C104	1500	2000	21R114121	HVD-30-1500	DD30-152
C105	1500		21R120100	BPD-0015	DD-152
C106	5000		21R124738	BPD-005	DD-502

Note 1: Not used in some versions.
Note 2: Some versions use a 470MMF in this applica

CONT

ITEM No.	RATING		REPLACEMENT		
	RESIST-ANCE	WATTS	MOTOROLA PART No.	CENTRALAB PART No.	CLAROST PART N
R1A	250Ω	½	18B739822		
B	1Meg	½	Not Req.		
C	Switch		Not Req.		
R2A	100K	½	18K737347		
B	Shaft		Not Req.		
R3A	2Meg	½	18K739556-P		
B	Shaft		Not Req.		
R4A	100K	½	18K739549		
B	Shaft		Not Req.		
R5A	5Meg	½	18K740693-O		
B	Shaft		Not Req.		
R6A	2Meg	½	18K739260		
B	Shaft		Not Req.		

Note #1: Alternate part #18C739822-A may be used in some v
Note #2: Alternate part #18K737347-P may be used in some
Note #3: Alternate part #18B733413, 5Meg with 1Meg stop may
Also, alternate part #18B706934, 4Meg with no stop
Note #4: Alternate part #18K739620 may be used in some ver

RESIST

All wattages 1/2 watt, or less

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	MOTOROLA PART No.	IRC PART No.	
R7	22K		6R6028	BTS-22K	
R8	47K		6R6056	BTS-47K	
R9	100K		6R6075	BTS-100K	
R10	2200Ω		6R6069	BTS-2200	
R11	1500Ω		6R6161	BTS-1500	
R12	39K		6R6487	BTS-39K	
R13	4700Ω		6R6039	BTS-4700	
R14	15K		6R124551	BTS-15K	
R15	15K		6R124551	BTS-15K	
R16	270K		6R6414	BTS-270K	
R17	8200Ω	1	6R5610	BTA-8200	
R18	15K		6R124551	BTS-15K	
R19	3300Ω		6R5581	BTS-3300	
R20	470Ω	1		BTA-470	Note 1
R21	1000Ω		6R6301		
R22	18K		6R5591		
R23	8200Ω	3	17K738283	PW4-8200	
R24	47Ω		6R5550	BTS-47	
R25	1000Ω		6R6301		
R26	18K				Note 2
R27	8200Ω	3	17K738283	PW4-8200	
R28	47Ω		6R5550	BTS-47	
R29	330K		6R2096		
R30	1200Ω		6R6393		
R31	47K		6R6048	BTS-47K	
R32	39K	1	6R5588	BTA-39K	
R33	8200Ω	2	6R5725	BTB-8200	
R34	1000Ω		6R6229		
R35	120Ω		6R5551	BTS-120	
R36	3900Ω		6R5659		
R37	220K		6R6407		Note 3
R38	100K			BTS-100K	Note 4
R39	100K		6R6031	BTS-100K	
R40	5000Ω	10	17K738325	PW10-5000	
R41	10K		6R6320		
R42	33K		6R6012		
R43	1Meg		6R6046		
R44	1.2Meg 5%		6K124495		
R45	8.2Meg 5%		6R114114	BTS-8.2Meg 5%	
R46	1000Ω		6R6301	BTS-1000	
R47	10K		6R6054	BTS-10K	
R48	150Ω		6R6373	BTS-150	
R49	82K		6R5644	BTS-82K	
R50	560K		6R5697	BTS-560K	

DESCRIPTIONS

S (cont)

REPLACEMENT DATA				NOTES
NELL- ILIER No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	
3	TC7-47	NT-5447	5TCU-Q33	
9	ED-1000	DC521	5HK-D1	
0	ED-470	UC-5347	5GA-T47	
1	HD3-1000	DC3021	20GA-Q33	
7	GP-3300	UC-5233	5HK-D33	
2	GP-10000	DC511	5HK-S1	
7	GP-3300	UC-5233	5HK-D33	
6D47		GEM-425	6TM-D47	
2	TC7-100	UC-531	5TCU-T1	
T68			MS-368	
T39			MS-339	
0	GP-5000	DC525	5HK-D5	
5			20HK-D5	
34P1		GEM-401	4TM-P1	
36P1		GEM-601	6TM-P1	
36P1		GEM-601	6TM-P1	
1	HD3-15		20GA-T15	
1	HD3-15		20GA-T15	
32P1		GEM-201	2TM-P1	
			20GA-Q82	
7	ED-820	UC-5375	5GA-T8	
7	ED-820	UC-5375	5GA-T8	
7	ED-820	UC-5375	5GA-T8	
7	ED-820	UC-5375	5GA-T8	
0	ED-470	UC-5347	5GA-T47	
0	GP-5000	DC525	5GA-D5	
7	ED-820	UC-5375	5GA-T8	
7	ED-820	UC-5375	5GA-T8	
0	ED-470	UC-5347	5GA-T47	
0	ED-470	UC-5347	5GA-T47	
0	ED-470	UC-5347	5GA-T47	Note 1
0	GP-5000	DC525	5GA-D5	
0	GP-5000	DC525	5GA-D5	
15	HD3-1500	DC30215		
	ED-1500	DC5215	5GA-D15	
0	GP-5000	DC525	5GA-D5	

S

IRC PART No.	MALLORY PART No.	INSTALLATION NOTES
		Contrast - Note #1
		Volume Tapⓐ 600K
		Attach to R1B
	PTA15L	Brightness
	Not Req.	Attach to R2A
	PTA26L	Vertical Hold - Note #4
	Not Req.	Attach to R3A
		Horiz. Hold - Note #2
		Attach to R4A
	PTA56L	Vertical Size - Note #3
	Not Req.	Attach to R5A
	PTA26L	Vertical Lin.
	Not Req.	Attach to R6A

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ed in some versions.

used in some versions.

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ss otherwise listed.

EM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	MOTOROLA PART No.	IRC PART No.	
	220Ω		6R3933	BTS-220	
2	560Ω		6R5691	BTS-560	
3	270K		6R6414	BTS-270K	
4	22K	1	6R6341	BTA-22K	
5	4700Ω		6R6039	BTS-4700	
6	68K		6R6001	BTS-68K	
7	100Ω		6R6018	BTS-100	
8	330Ω	1	6R6254	BTA-330	
9	470Ω	1	6R5593	BTA-470	
0	10K		6R6320	BTS-10K	
	1. 5Meg		6R3966	BTS-1. 5Meg	
2	270K		6R6414	BTS-270K	
3	1Meg		6K124494	BTS-1Meg	
4	560K		6R5697	BTS-560K	
5	22K		6R6397	BTS-22K	
6	27K	1	6R6427	BTA-27K	
7	1800Ω		6R2089	BTS-1800	
8	2200Ω		6R6069	BTS-2200	
9	180K		6R6444	BTS-180K	
0	18K		6R5591	BTS-18K	
	22K		6K119935	BTS-22K	
2	6. 8Meg		6K124735	BTS-6. 8Meg	
3	1Meg		6R6046	BTS-1Meg	
4	680K		6R6475	BTS-680K	
5	15K		6R6477	BTS-15K	
6	8200Ω		6R2004	BTS-8200	
7	180K		6R6444	BTS-180K	
8	18K		6R122848	BTS-18K	
9	1Meg		6R6004	BTS-1Meg	Note 5
0	3. 3Meg		6R6497	BTS-3. 3Meg	
	330K		6R2096	BTS-330K	
2	470K		6R6032	BTS-470K	
3	150Ω	1	6R6330	BTA-150	
4	22K		6R119935	BTS-22K	
5	68K		6R6001	BTS-68K	
6	10K		6R6320	BTS-10K	
7	560Ω		6R6291		
8	560Ω		6R6291		
9	100K		6R6031		
0	22K		6R6397		
1	100K		6R6031		
2	100K		6R6031		
3	4. 7Meg		6R2122		
4	220K	1	6K124455		

RESISTORS (cont)

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	MOTOROLA PART No.	IRC PART No.	
R95	8200Ω		6R2004		Note 6
R96	56K		6R6378		Note 7
R97	220K		6R6407		Note 5
R98	1000Ω		6R6229		
R99	120K		6R5631		
R100	18K		6K122848		
R101	1Meg				Note 8
R102	470Ω		6R3949		
R103	1Meg		6R6046		
R104	1000Ω		6R6229	BTS-1000	

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	MOTOROLA PART No.	IRC PART No.	
R105	15K 5%	2	6R5732	BTB-15K 5%	Note 9
R106	3300Ω		6R5581		
R107	47K		6R6048		
R108	330K		6R6014		
R109	6800Ω	1	6K124699		
R110	6. 8Ω		17K484269	BW½-6. 8	
R111	35Ω	15	17B739317		
R112	12K 5%	2	6K124737	BTB-12K 5%	
R113	7. 5Ω		17K740609	FR7. 5	
R114	2. 2Meg		6R3927	BTS-2. 2Meg	

Note 1: Some versions may use 1500Ω, 2W in this application.
Note 2: Some versions may use 10K part #6R6320 in this application.
Note 3: Some versions may use 150K in this application.
Note 4: Some versions may use 33K part #6R6012 in this application.
Note 5: Not used in some versions.
Note 6: Some versions may use 5600Ω in this application.
Note 7: Some versions may use 100K in this application.
Note 8: Some versions may use 2. 2Meg part #6R6433 in this application.
Note 9: Some versions may use 12K, 2W in this application.

TRANSFORMERS (SWEEP CIRCUITS)

ITEM No.	USE	REPLACEMENT DATA							
		MOTOROLA PART No.	Halldorson PART No.	Merit PART No.	RCA TYPE No.	Ram PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
T1	Horiz. Output Trans.	24C739283 ①							
T2	Vert. Output Trans.	25B738716	Z1900②③	A-2823②④		V316 ⑤	A-8148 ⑤	26S72②④	A-108X②④
T3A	Yoke(90°)Horiz(24MH)	24D739275	DF607⑦⑧	MDF-92⑦	235D1 ⑦⑧	Y90F19/43	DY-16A⑦	Y-16 ⑦⑧	Y-41-1 ⑦
B	Vert(40MH)	48A721145⑥	⑨	⑧ ⑨	⑨	⑦⑧⑨	⑧⑨	⑨	⑧ ⑨

① Complete assembly. Includes: primary coil, Motorola part no. 24B739281.
secondary coil, Motorola part no. 24K737218.
core, Motorola part no. 46K735112 or 46K740227.

② Connect as auto trans.
③ Use 7 to 1 turns ratio.
④ Drill new mounting hole(s).
⑤ Cut and tape green lead.
⑥ Yoke rear cover and centering device.
⑦ Use orig. rear cover and centering device.
⑧ Use orig. horiz. yoke damping network with capacitor C93 across terms #3 and #7.
⑨ Connect horiz. yoke term #3 to yoke plug pin #4; horiz. yoke terms #2 and #7 to yoke plug pin #5; horiz. yoke term #1 to yoke plug pin #6.

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE		REPLACEMENT DATA						NOTES
	PRI.	SEC.	MOTOROLA PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.	
T4	5. 2K	3-4Ω	25B738848 ①	Z1000	A-2930	A-3877	24S51	S-6X ②	① Alternate part #25C738848. ② Drill one new mtg. hole.

SPEAKER

ITEM No.	RATINGS			REPLACEMENT DATA			NOTES
	SIZE	FIELD	V. C. IMP.	MOTOROLA PART No.	QUAM PART No.	RCA TYPE No.	
SP1	5 1/4"	PM	3-4Ω	50K739371 ①	52A1	217S1	① Used in models 21T32BA, CHA;Y21T32BA, CHA; 21T32B, CH;Y21T32B, CH;21T32MGA, Y21T32MGA.
	5 1/4"	PM	3-4Ω	50D739234 ②	52A1	217S1	② Used in models 21T34BA, MA;Y21T34BA, MA; 21T34B, M;Y21T34B, M.
	8"	PM	3-4Ω	50D739233③			③ Used in models 21K53BA, MA;Y21K53BA, MA; 21K53B, M;Y21K53B, M.
	8"	PM	3-4Ω	50K739881 ④			④ Used in models 21K55BA, MA;Y21K55BA, MA; 21K55B, M;Y21K55B, M.
	8"	PM	3-4Ω	50K740265 ⑤			⑤ Used in models 24K13B, M;Y24K13B, M.
	6"	PM	3-4Ω	50D739878 ⑥			⑥ Used in models 24T5BG, MG;Y24T5BG, MG.

COILS (RF-IF)

ITEM No.	USE	MOTOROLA PART No.	NOTES
L1	Ant. Trans.	24B739909	
L2	IF Trap	24B739500	
L3	Ant. Coils	24C740040	Channels 2-6 ①
L4	Ant. Coil	24K739634	Channel 13
L5	Fil. Choke	24K730391	
L6	Neut. Coil	24A739397	
L7	RF Coil	24A739361	Channel 13
L8	RF Coils	24K740465	Channels 2-6 ②
L9	Osc. Coil	24C739381	Channel 2

ITEM No.	USE	MOTOROLA PART No.	NOTES
L10	Osc. Coil	24K739382	Channel 3
L11	Osc. Coil	24C739381	Channel 4
L12	Osc. Coil	24A739384	Channel 5
L13	Osc. Coil	24K739385	Channel 6
L14	Osc. Coil	24K739386	Channel 13
L15	RF Choke	24A739380	
L16	Conv. Plate	24B739079	
L17	Fil. Choke		

① Complete coil and wafer assembly. Includes L1, L2, L3, L4.
② Complete coil and wafer assembly.

ITEM No.	USE	DC RES.		REPLACEMENT DATA				NOTES
		PRI.	SEC.	MOTOROLA PART No.	MEISSNER PART No.	MERIT PART No.	MILLER PART No.	
L18	1st Video IF	. 1Ω	. 1Ω	24B737850	17-4522			
L19A	Bandwidth Coil	0Ω		24K738123				
B	41. 4MC Trap	. 1Ω						
L20	Fil. Choke	0Ω		24K730391	19-1001		4604	1. 3 Microhenries
L21	Fil. Choke	0Ω		24K730391	19-1001		4604	1. 3 Microhenries
L22	2nd Video IF	. 1Ω	. 1Ω	24B736267	17-4522	TV-130	6219	
L23	Fil. Choke	0Ω		24K730391	19-1001		4604	1. 3 Microhenries
L24	3rd Video IF	. 1Ω	. 1Ω	24B736268	17-4522	TV-130	6219	
L25	RF Choke	0Ω		24A737829			4602	1. 24 Microhenries
L26	Fil. Choke	0Ω		24K730391	19-1001		4604	1. 3 Microhenries
L27	Series Peaking Coil	1. 5Ω		24A737829	19-1005		4612	10 Microhenries
L28	Shunt Peaking Coil	5. 3Ω		24C736006	19-3180	TV-184	6180	180 Microhenries
L29	Series Peaking Coil	6. 5Ω		24K740513	19-3250■	TV-185■	6181■	240 Microhenries;Wound on 5600Ω resistor
L30	4. 5MC Trap	4. 5Ω		24K739290	20-1004			
L31	Series Peaking Coil	6. 5Ω		24K740513	19-3250■	TV-185■	6181■	240 Microhenries;Wound on 5600Ω resistor
L32	Shunt Peaking Coil	8. 2Ω		24K740117	19-3300		6132	330 Microhenries
L33	Shunt Peaking Coil	14. 5Ω		24K740512			6156▲	880 Microhenries;Wound on 2700Ω resistor

PARTS LIST AND DESCRIPTIONS (Continued)

COILS (cont)

ITEM No.	USE	DC RES.		REPLACEMENT DATA				NOTES
		PRI.	SEC.	MOTOROLA PART No.	MEISSNER PART No.	MERIT PART No.	MILLER PART No.	
L34	RF Choke	1.5Ω		24A737733	19-1005		4612	10 Microhenries
L35	lst Sound IF	3Ω		24B739304				Tapped @ 1.4Ω
L36	2nd Sound IF	7.5Ω	8Ω	24B738943				
L37	RF Choke	1.6Ω		24K737733	19-1005		4612	10 Microhenries
L38	Quadrature Coil	3.7Ω		24B738942				
L39	Fil. Choke	0Ω		24K730391	19-1001		4604	1.3 Microhenries
L40	RF Choke	1.5Ω		24A733225	19-1005		4612	10 Microhenries
L41	RF Choke	1.5Ω		24A733225	19-1005		4612	10 Microhenries

■ Parallel with 5600Ω resistor.
▲ Parallel with 2700Ω resistor.

TRANSFORMER (HORIZ. OSC.)

ITEM No.	DC RES.		REPLACEMENT DATA							NOTES
	PRI.	SEC.	MOTOROLA PART No.	MEISSNER PART No.	MERIT PART No.	MILLER PART No.	RCA TYPE No.	Ram PART No.	Thordarson PART No.	
L42	37Ω		1V739709	19-1576	TV-163	6210			HS-5	

FILTER CHOKE

ITEM No.	RATINGS			REPLACEMENT DATA					
	TOTAL DIRECT CURRENT	D. C. RESISTANCE	INDUCTANCE (0 CURRENT 1000 ∿)	MOTOROLA PART No.	Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
L43	.260A	49Ω	1.54HY	25K738763	C5037 ①	C-2996 ①	C-2326 ①	26C44	C-17X ①

① Drill one new mounting hole.

COMPONENT COMBINATIONS

ITEM No.	USE	DESCRIPTION	MOTOROLA PART No.	REPLACEMENT DATA	
K1	Ant. Input	470MMF @ 1500V Cap. & 1Meg ½W Res.	51B740235	CRL	DA632
K2	Ant. Input	470MMF @ 1500V Cap. & 1Meg ½W Res.	51B740235	CRL	DA632

SELENIUM RECTIFIER

ITEM No.	RATING	REPLACEMENT DATA						NOTES
	CURRENT	MOTOROLA PART No.	FEDERAL PART No.	INTERNATIONAL PART No.	MALLORY PART No.	RADIO RECEPTOR PART No.	SARKES TARZIAN PART No.	
M1	.260A	48K122479	1238A	RS350	6S350	5QS1	350A	
M2	.260A	48K122479	1238A	RS350	6S350	5QS1	350A	

CRYSTAL DIODES

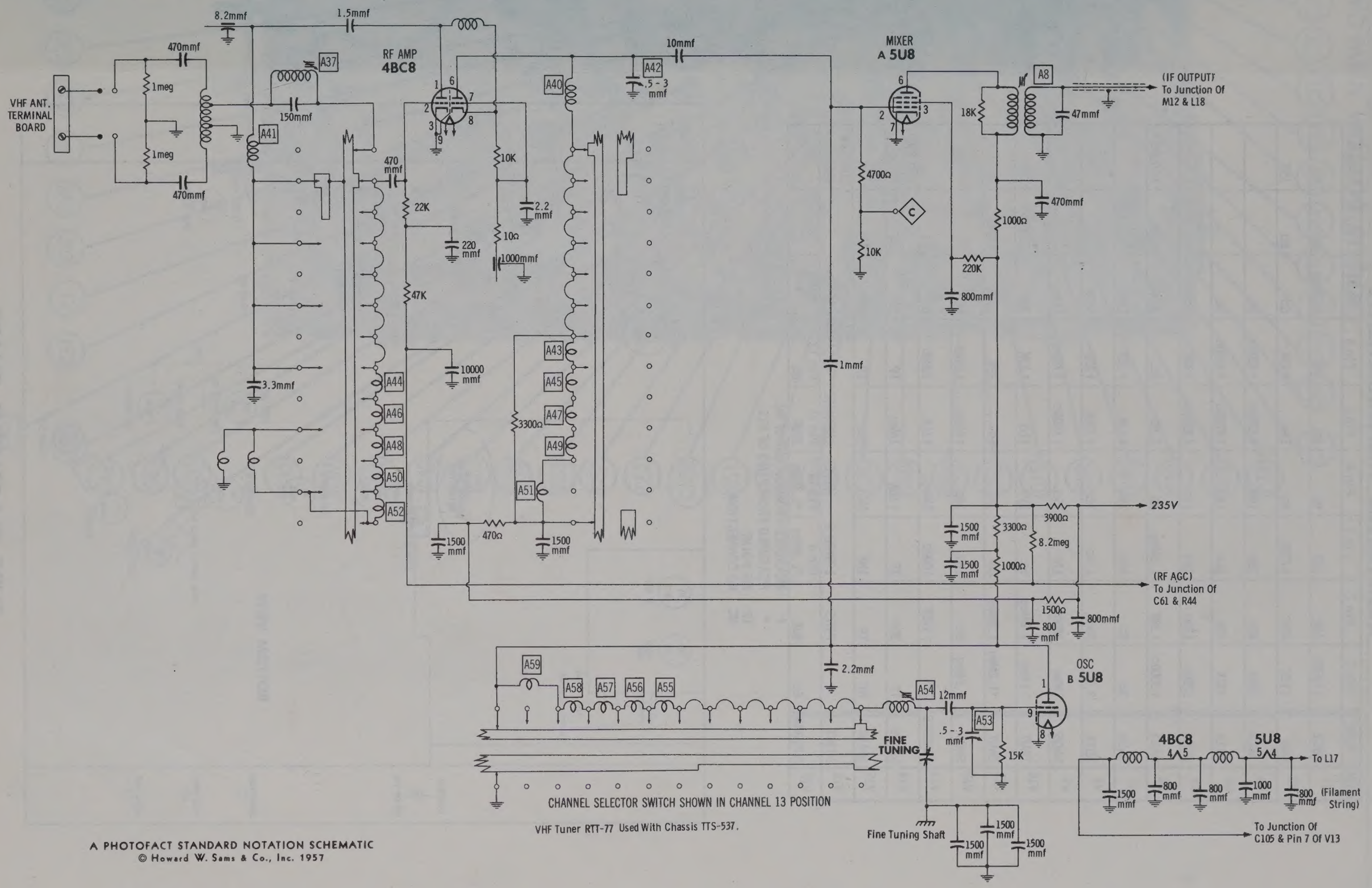
ITEM No.	ORIG. TYPE	REPLACEMENT DATA		NOTES
		MOTOROLA PART No.	SYLVANIA PART No.	
M3		48C739300 *	1N60	Video Det. - (Plug in type)

*Alternate part #48K733204 (Plug in type)
Alternate part #48K722720 (Pigtail)

MISCELLANEOUS

ITEM No.	PART NAME	MOTOROLA PART No.	NOTES
M4	Tuner		TT-86A, VHF, Used in some versions of chassis TS-537, WTS-537.
	Tuner	1U738980	TT-86, VHF, Used in some versions of chassis TS-537, WTS-537.
	Tuner	1U738948	TT-86Y, VHF, Used in chassis TS-537Y, WTS-537Y.
	Tuner	1V738788	RTT-77, VHF, Used in chassis TTS-537.
	Tuner	1V738897	QTT-78, VHF, Used in chassis TTS-537Y.
M5	Tuner		WTT-87, UHF, Used in chassis TS-537Y, WTS-537Y.
	Tuner		NTT-37, UHF, Used in chassis TTS-537Y.
M6	Detector Ass'y.	24C739298	Includes 4th Video IF, 5.6 MMF Cap., 10MMF Cap., and M3 Crystal (Plug In). Alternate part #24C736478, M3 Crystal (Pigtail)
M7	Switch	40B736126	On-Off (Push Type) Used in chassis WTS-537, WTS-537Y only.
M8	Centering Device	48A721145-C	Includes yoke cover.
M9	Ion Trap	59K734028	
M10	Correction Magnet	48B737088	Alternate part #48B737087.
M11	Correction Magnet	48B737088	Alternate part #48B737087.
M12	Trimmer Cap.	20A736287	IF Link (20-140MMF)
	Knob	36B738679	Contrast - Models 21K53B, BA, M, MA, 21K55B, BA, M, MA, 21T32B, BA, CH, CHA, 21T34B, BA, M, MA, Y21K53B, BA, M, MA, Y21K55B, BA, M, MA, Y21T32B, BA, CH, CHA, Y21T34B, BA, M, MA.
	Knob	36B738701	Contrast - Models 24T5BG, MG, Y24T5BG, MG, 24K13B, M, Y24K13B, M.
	Knob	36B738677	Horiz. Hold, Vert. Hold & Brightness (White)
	Knob	36B738714	Horiz. Hold, Vert. Hold & Brightness (Clear)
	Knob	36K738296	Fine Tuning - Models 21K53B, BA, M, MA, 21K55B, BA, M, MA, 21T32B, BA, CH, CHA, 21T34B, BA, M, MA, Y21K53B, BA, M, MA, Y21K55B, BA, M, MA, Y21T32B, BA, CH, CHA, Y21T34B, BA, M, MA.
	Knob	36K738680	Fine Tuning - Models 21K53BA, MA, Y21K53BA, MA, 21T32BA, Y21T32BA, 21T34BA, MA, Y21T34BA, MA.
	Knob	36C738713	Fine Tuning - Models 24K13B, M, Y24K13B, M, 24T5BG, MG, Y24T5BG, MG.
	Knob	36B738678	On-Off Volume - All Models.
	Knob	36K739331	VHF Channel Selector - Models 21K53B, M, 21T32B, CH, 21T34B, M.
	Knob	36K738682	VHF Channel Selector - Models 21K53BA, MA, 21K55BA, MA, 21T32BA, CHA, 21T34BA, MA.
	Knob	36C739330	VHF Channel Selector - Models Y21K53B, M, Y21T32B, CH, Y21T34B, M.
	Knob	36C738681	VHF Channel Selector - Models Y21K53BA, MA, Y21K55BA, MA, Y21T32BA, CHA, Y21T·4BA, MA.
	Knob	36K738936	VHF Channel Selector - Models 24K13B, M, 24T5BG, MG.
	Knob	36C738935	VHF Channel Selector - Models Y24K13B, M, Y21T5BG, MG.
	Glass	61K736858	Safety, Tinted - 21" Models
	Glass	61K738649	Safety, Tinted - 24" Models

ALTERNATE VHF TUNER


VHF ANT. TERMINAL BOARD
1meg
1meg
470mmf
470mmf
8.2mmf
1.5mmf
150mmf
A37
A41
3.3mmf
RF AMP
4BC8
470 mmf
22K
220 mmf
47K
10000 mmf
10K
2.2 mmf
10Ω
1000mmf
A40
A42
.5 - 3 mmf
10mmf
A43
A44
A45
A46
A47
A48
A49
A50
A51
A52
3300Ω
470Ω
1500 mmf
1500 mmf
1mmf
MIXER
A 5U8
4700Ω
C
10K
220K
800mmf
1000Ω
470mmf
18K
A8
47mmf
(IF OUTPUT)
To Junction Of
M12 & L18
235V
3900Ω
3300Ω
8.2meg
1000Ω
1500 mmf
1500 mmf
(RF AGC)
To Junction Of
C61 & R44
1500Ω
800 mmf
800mmf
OSC
B 5U8
2.2mmf
A59
A58
A57
A56
A55
A54
12mmf
A53
.5 - 3 mmf
15K
FINE TUNING
Fine Tuning Shaft
1500 mmf
1500 mmf
1500 mmf
4BC8
4 5
5U8
5 4
To L17
1500 mmf
800 mmf
800 mmf
1000 mmf
800 mmf
(Filament String)
To Junction Of
C105 & Pin 7 Of V13
CHANNEL SELECTOR SWITCH SHOWN IN CHANNEL 13 POSITION

VHF Tuner RTT-77 Used With Chassis TTS-537.

A PHOTOFACT STANDARD NOTATION SCHEMATIC

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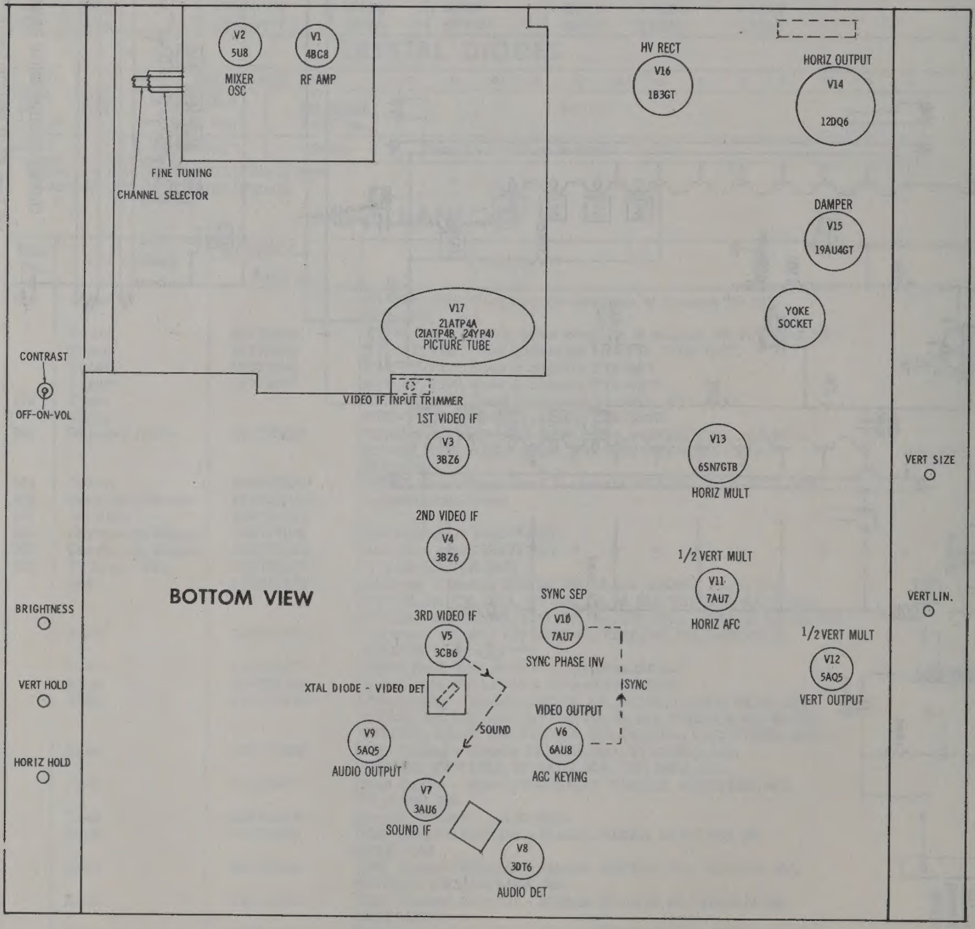
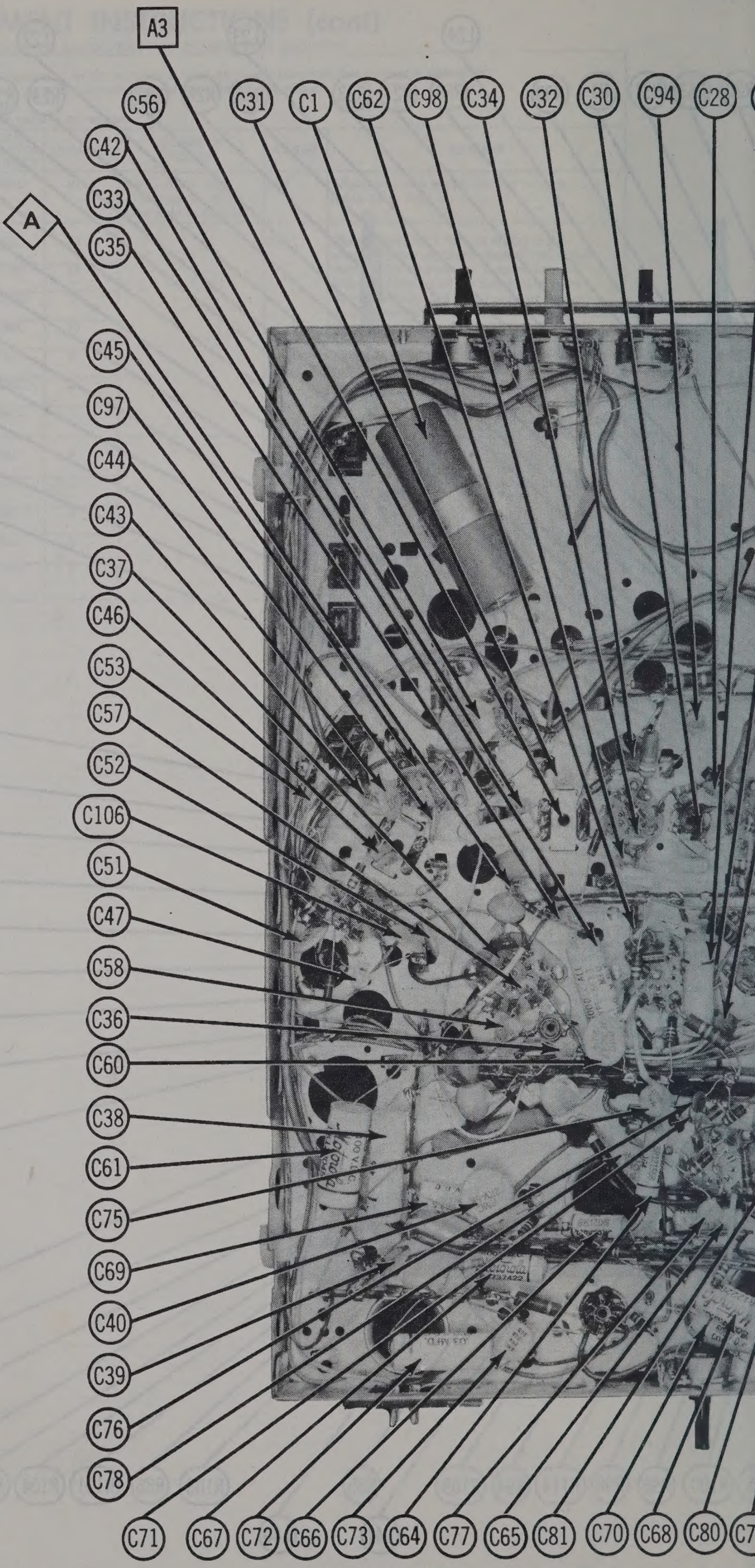
RESISTANCE MEASUREMENTS

ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	4BC8	†1800Ω	INF	INF	9Ω	8Ω	INF	2.2Meg	0Ω	0Ω
V2	5U8	†12K	45K	†270K	9Ω	11Ω	†15K	0Ω	0Ω	15K
V3	3BZ6	332K	47Ω	20Ω	19Ω	†8200Ω	†8200Ω	0Ω		
V4	3BZ6	332K	47Ω	19Ω	18Ω	†8200Ω	†8200Ω	0Ω		
V5	3CB6	1200Ω	120Ω	18Ω	17Ω	†8200Ω	†39K	0Ω		
V6	6AU8	†3300Ω	†38K	1.2Meg	4Ω	1.5Ω	6Ω	3900Ω	†12K	†5000Ω
V7	3AU6	3Ω	0Ω	14Ω	15Ω	†13K	†32K	150Ω		
V8	3DT6	9.5Ω	560Ω	1.5Ω	1Ω	†270K	†22K	560K		
V9	5AQ5	1Meg	330Ω	17Ω	15Ω	†1000Ω	†700Ω	1Meg		
V10	7AU7	†1Meg	2.2Meg	6Ω	11Ω	11Ω	†33K	20K	2200Ω	12Ω
V11	7AU7	*1.2Meg	1.8Meg	0Ω	1Ω	1Ω	22K	330K	120K	0Ω
V12	5AQ5	1.5Meg	0Ω	12Ω	14Ω	†600Ω	†200Ω	NC		
V13	6SN7GTB	70K	†120K	1000Ω	5Meg	†11K	1000Ω	6Ω	8Ω	
V14	12DQ6	TP	20Ω	TP	†16K	1Meg	TP	22Ω	0Ω	TOP CAP 12.5Ω
V15	19AU4	NC	TP	INF	NC	50Ω	TP	24Ω	22Ω	
V16	1B3GT	PINS 1 THRU 8 HAVE INFINITE RESISTANCE								TOP CAP 182Ω
V17	21ATP4A	4Ω	80K	Pin 6 *1.3Meg	Pin 10 *1.3Meg	Pin 11 270K	Pin 12 6Ω			

† MEASURED FROM OUTPUT OF M1.
* MEASURED FROM PIN 3 OF V15.
TP TIE POINT
NC NO CONNECTION


V2
5U8
MIXER OSC
V1
4BC8
RF AMP
FINE TUNING
CHANNEL SELECTOR
HV RECT
V16
1B3GT
HORIZ OUTPUT
V14
12DQ6
DAMPER
V15
19AU4GT
YOKE SOCKET
V17
21ATP4A
(21ATP4B, 24YP4)
PICTURE TUBE
CONTRAST
OFF-ON-VOL
VIDEO IF INPUT TRIMMER
1ST VIDEO IF
V3
3BZ6
V13
6SN7GTB
HORIZ MULT
VERT SIZE
2ND VIDEO IF
V4
3BZ6
1/2 VERT MULT
V11
7AU7
HORIZ AFC
BOTTOM VIEW
SYNC SEP
V10
7AU7
SYNC PHASE INV
VERT LIN.
BRIGHTNESS
3RD VIDEO IF
V5
3CB6
1/2 VERT MULT
V12
5AQ5
VERT OUTPUT
VERT HOLD
XTAL DIODE - VIDEO DET
SYNC
VIDEO OUTPUT
V6
6AU8
AGC KEYING
SOUND
V9
5AQ5
AUDIO OUTPUT
HORIZ HOLD
V7
3AU6
SOUND IF
V8
3DT6
AUDIO DET

TUBE PLACEMENT CHART

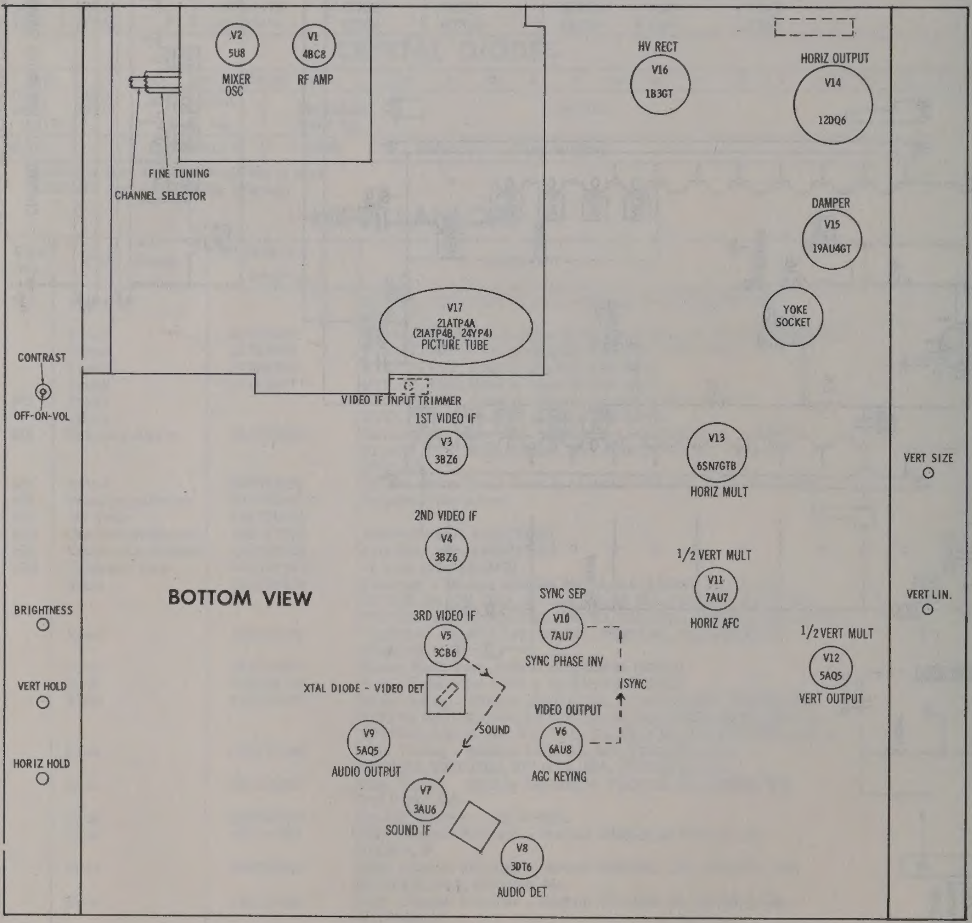

A3
C56
C31
C1
C62
C98
C34
C32
C30
C94
C28
C42
C33
A
C35
C45
C97
C44
C43
C37
C46
C53
C57
C52
C106
C51
C47
C58
C36
C60
C38
C61
C75
C69
C40
C39
C76
C78
.05 MFD.
C71
C67
C72
C66
C73
C64
C77
C65
C81
C70
C68
C80

CHASSIS BOTTOM VIEW-CAPACITO

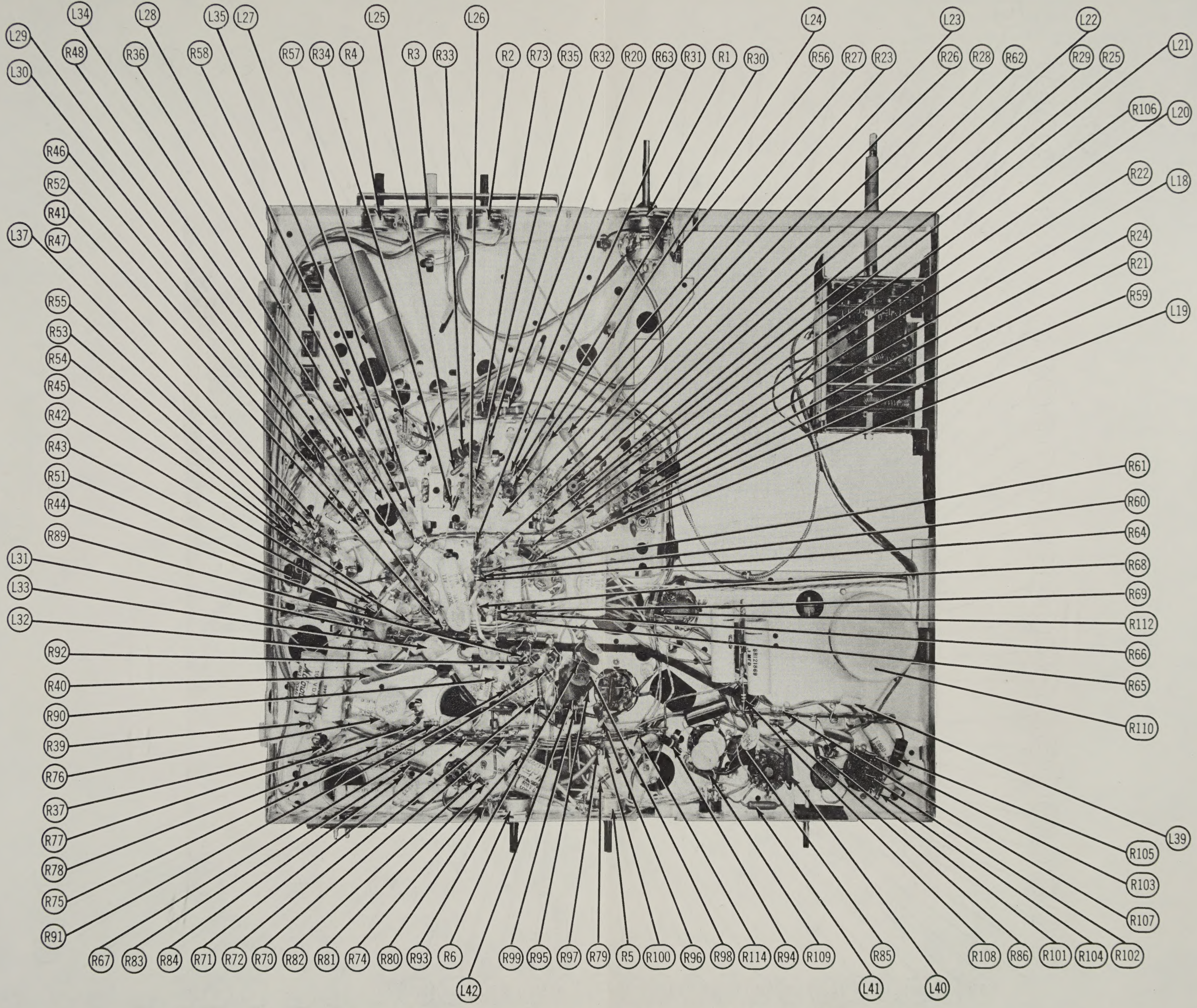
RESISTANCE MEASUREMENTS

ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	4BC8	†1800Ω	INF	INF	9Ω	8Ω	INF	2.2Meg	0Ω	0Ω
V2	5U8	†12K	45K	†270K	9Ω	11Ω	†15K	0Ω	0Ω	15K
V3	3BZ6	332K	47Ω	20Ω	19Ω	†8200Ω	†8200Ω	0Ω		
V4	3BZ6	332K	47Ω	19Ω	18Ω	†8200Ω	†8200Ω	0Ω		
V5	3CB6	1200Ω	120Ω	18Ω	17Ω	†8200Ω	†39K	0Ω		
V6	6AU8	†3300Ω	†38K	1.2Meg	4Ω	1.5Ω	6Ω	3900Ω	†12K	†5000Ω
V7	3AU6	3Ω	0Ω	14Ω	15Ω	†13K	†32K	150Ω		
V8	3DT6	9.5Ω	560Ω	1.5Ω	1Ω	†270K	†22K	560K		
V9	5AQ5	1Meg	330Ω	17Ω	15Ω	†1000Ω	†700Ω	1Meg		
V10	7AU7	†1Meg	2.2Meg	6Ω	11Ω	11Ω	†33K	20K	2200Ω	12Ω
V11	7AU7	*1.2Meg	1.8Meg	0Ω	1Ω	1Ω	22K	330K	120K	0Ω
V12	5AQ5	1.5Meg	0Ω	12Ω	14Ω	†600Ω	†200Ω	NC		
V13	6SN7GTB	70K	†120K	1000Ω	5Meg	†11K	1000Ω	6Ω	8Ω	
V14	12DQ6	TP	20Ω	TP	†16K	1Meg	TP	22Ω	0Ω	TOP CAP 12.5Ω
V15	19AU4	NC	TP	INF	NC	50Ω	TP	24Ω	22Ω	
V16	1B3GT	PINS 1 THRU 8 HAVE INFINITE RESISTANCE								TOP CAP 182Ω
V17	21ATP4A	4Ω	80K	Pin 6 *1.3Meg	Pin 10 *1.3Meg	Pin 11 270K	Pin 12 6Ω			

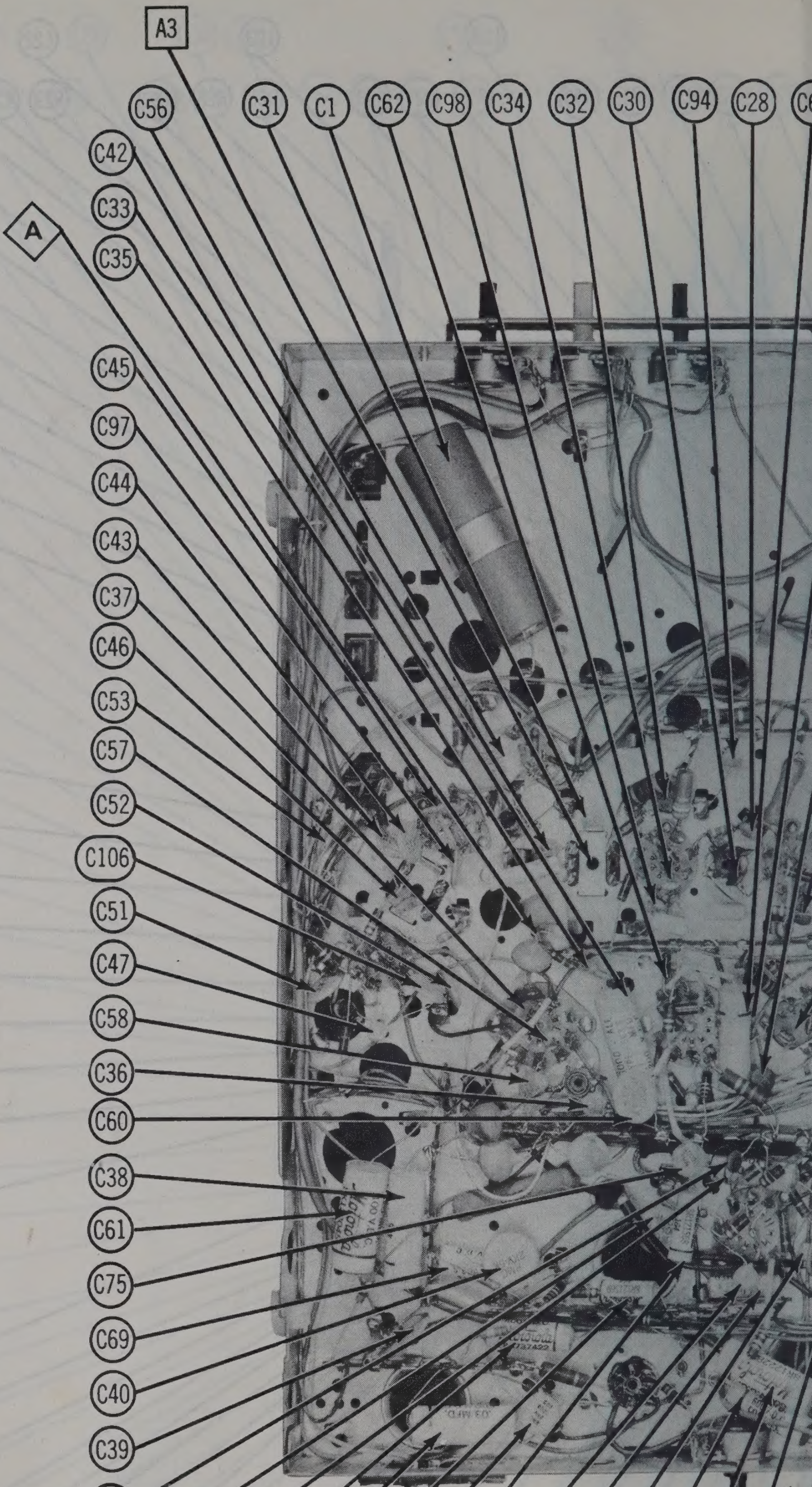
† MEASURED FROM OUTPUT OF M1.
* MEASURED FROM PIN 3 OF V15.
TP TIE POINT
NC NO CONNECTION


V2
5U8
MIXER OSC
V1
4BC8
RF AMP
FINE TUNING
CHANNEL SELECTOR
HV RECT
V16
1B3GT
HORIZ OUTPUT
V14
12DQ6
DAMPER
V15
19AU4GT
V17
21ATP4A
(21ATP4B, 24YP4)
PICTURE TUBE
YOKE SOCKET
CONTRAST
OFF-ON-VOL
VIDEO IF INPUT TRIMMER
1ST VIDEO IF
V3
3BZ6
V13
6SN7GTB
HORIZ MULT
VERT SIZE
2ND VIDEO IF
V4
3BZ6
1/2 VERT MULT
V11
7AU7
HORIZ AFC
VERT LIN.
BRIGHTNESS
BOTTOM VIEW
SYNC SEP
V10
7AU7
SYNC PHASE INV
3RD VIDEO IF
V5
3CB6
1/2 VERT MULT
V12
5AQ5
VERT OUTPUT
VERT HOLD
XTAL DIODE - VIDEO DET
SYNC
VIDEO OUTPUT
V6
6AU8
AGC KEYING
SOUND
HORIZ HOLD
V9
5AQ5
AUDIO OUTPUT
V7
3AU6
SOUND IF
V8
3DT6
AUDIO DET

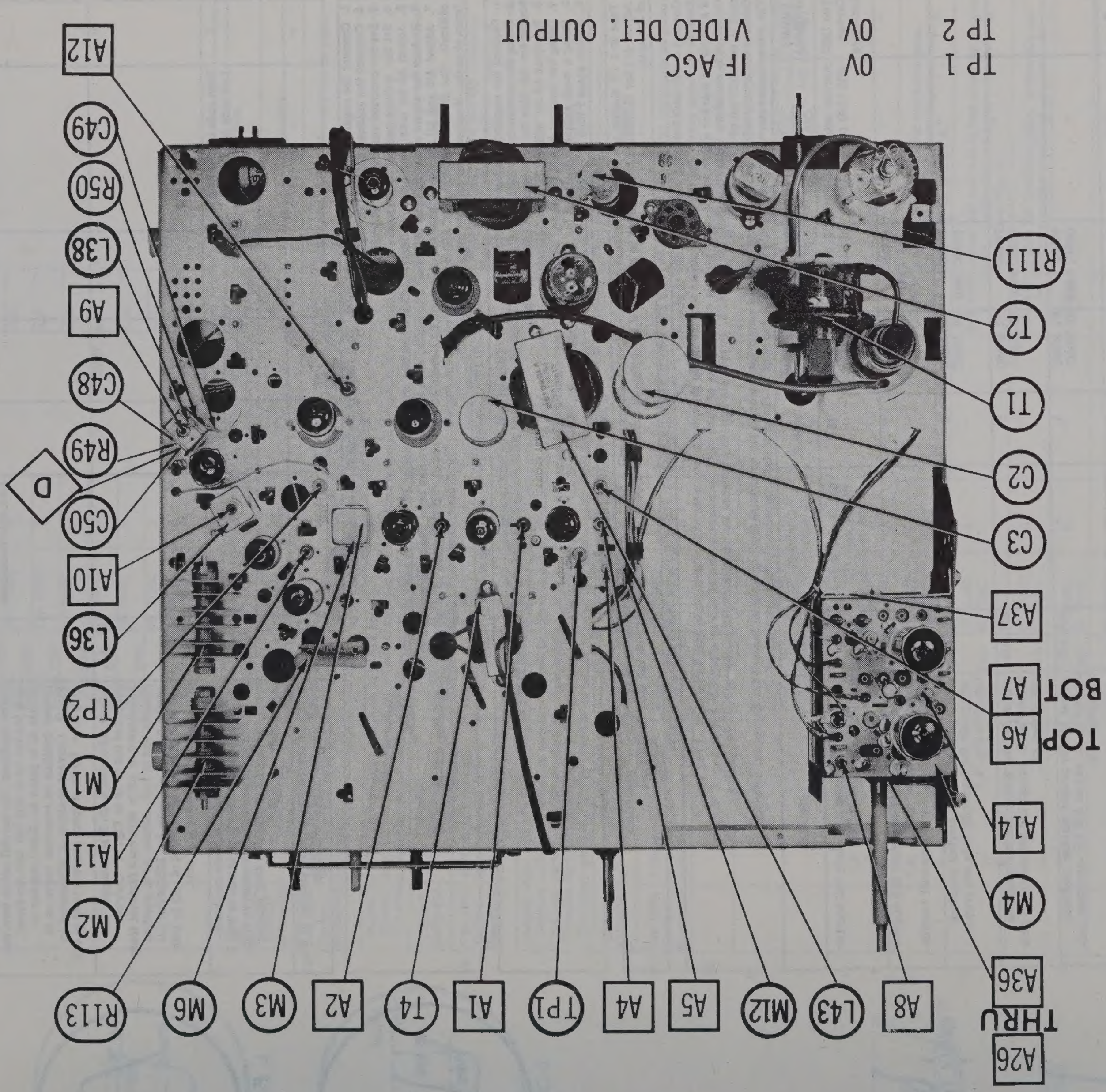
TUBE PLACEMENT CHART


L34
L28
L35
L27
L25
L26
L24
L23
L22
L29
R48
R36
R58
R57
R34
R4
R3
R33
R2
R73
R35
R32
R20
R63
R31
R1
R30
R56
R27
R23
R26
R28
R62
R29
R25
L21
L30
R106
L20
R22
L18
R24
R21
R59
L19
R46
R52
R41
L37
R47
R55
R53
R54
R45
R42
R43
R51
R44
R89
L31
L33
L32
R92
R40
R90
R39
R76
R37
R77
R78
R75
R91
R61
R60
R64
R68
R69
R112
R66
R65
R110
L39
R105
R103
R107
R67
R83
R84
R71
R72
R70
R82
R81
R74
R80
R93
R6
R99
R95
R97
R79
R5
R100
R96
R98
R114
R94
R109
R85
R108
R86
R101
R104
R102
L42
L41
L40

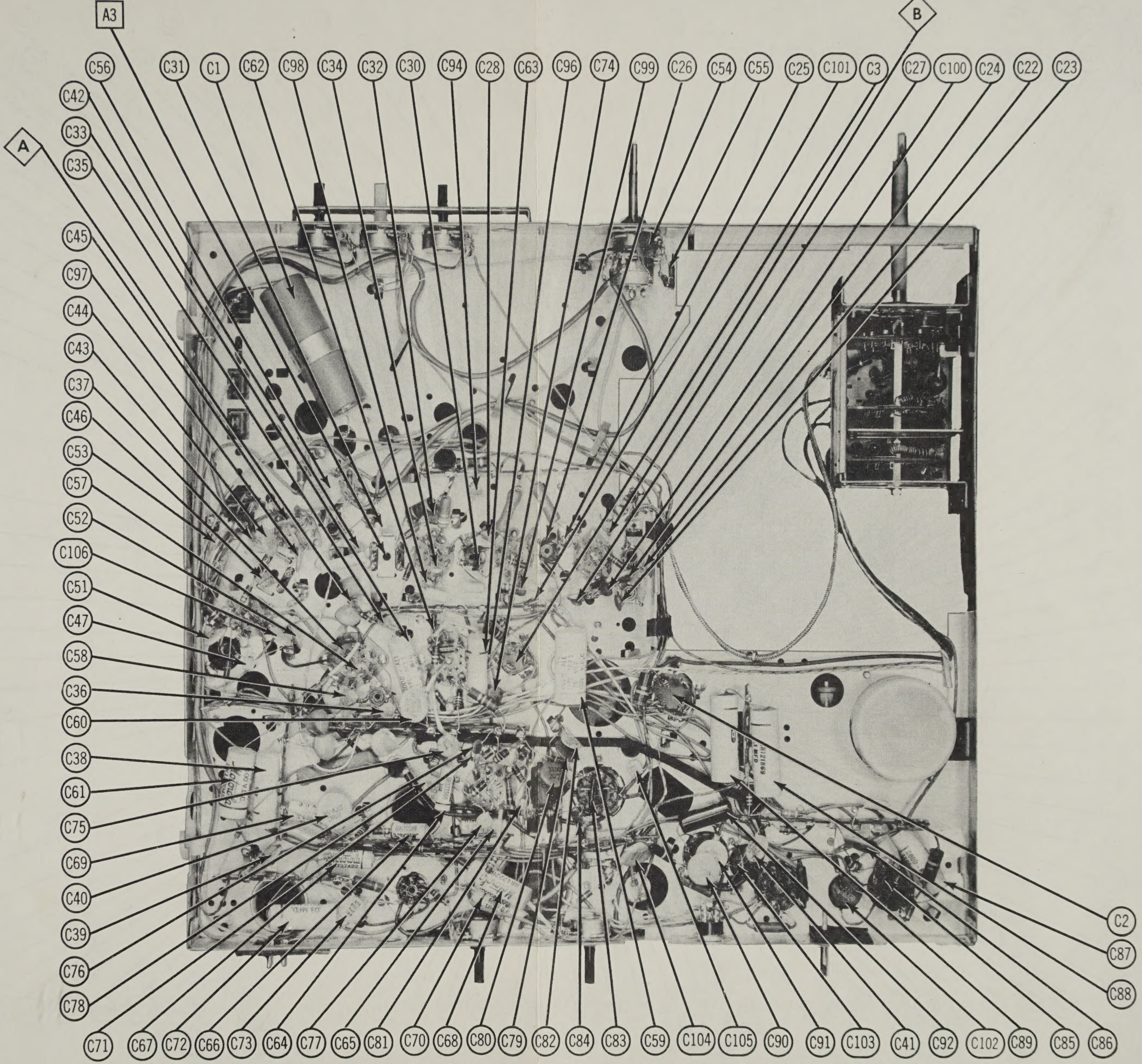
CHASSIS BOTTOM VIEW-RESISTOR AND INDUCTOR IDENTIFICATION


A3
A
C56
C31
C1
C62
C98
C34
C32
C30
C94
C28
C6
C42
C33
C35
C45
C97
C44
C43
C37
C46
C53
C57
C52
C106
C51
C47
C58
C36
C60
C38
C61
C75
C69
C40
C39
C76
C78
C71
C67
C72
C66
C73
C64
C77
C65
C81
C70
C68
C80
C79

CHASSIS BOTTOM VIEW-CAPACITO


TP 1 0V IF AGC
TP 2 0V VIDEO DET. OUTPUT
R113
M2
A11
M1
TP2
L36
A10
C50
D
R49
C48
A9
L38
R50
C49
A12
M6
M3
A2
T4
A1
TP1
A4
A5
M12
L43
A8
A26
THRU
A36
M4
A14
TOP A6
BOT A7
A37
C3
C2
T1
T2
R111

CHASSIS TOP VIEW


A3
B
C56
C31
C1
C62
C98
C34
C32
C30
C94
C28
C63
C96
C74
C99
C26
C54
C55
C25
C101
C3
C27
C100
C24
C22
C23
C42
C33
A
C35
C45
C97
C44
C43
C37
C46
C53
C57
C52
C106
C51
C47
C58
C36
C60
C38
C61
C75
C69
C40
C39
C76
C78
C2
C87
C88
C71
C67
C72
C66
C73
C64
C77
C65
C81
C70
C68
C80
C79
C82
C84
C83
C59
C104
C105
C90
C91
C103
C41
C92
C102
C89
C85
C86

CHASSIS BOTTOM VIEW-CAPACITOR AND ALIGNMENT IDENTIFICATION

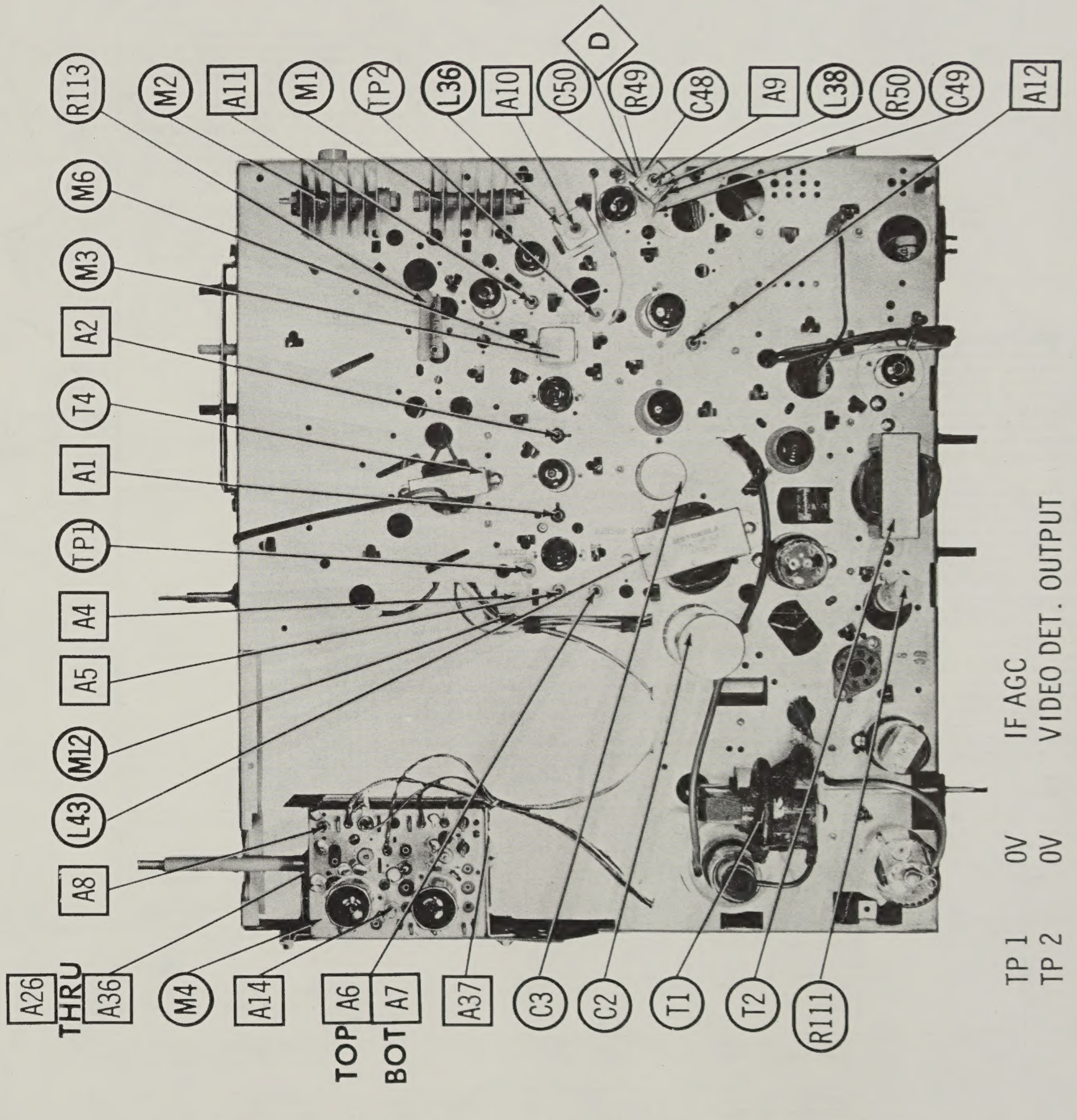
ALIGNMENT INSTRUCTIONS (cont)

VHF OSCILLATOR ALIGNMENT FOR TUNERS TT77 AND TT78

Connect the bias as under "Video IF Alignment".
Connect the synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.
The sweep generator output lead should be terminated with its characteristic impedance, usually 50 ohms.
Set the fine tuning control to the mid-position of its range.
Use only enough sweep generator output to provide usable pattern on scope.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
23.	Two 120Ω Carbon Resistors	Across VHF antenna terminals with 120Ω in each lead.	195MC (10MC Swp)	197.75MC	10	Vert. Amp. thru 47K to point Ⓒ. Low side to chassis.	A53	Adjust to place sound marker in trap notch as in Fig. 10.
24.	"	"	213MC (10MC Swp)	215.75MC	13		A54	Check channels 7 thru 13 noting if the sound marker for each channel falls just above the trap notch. If more than 40 degrees rotation of the fine tuning is required to place the sound marker in the proper position on any high channel, set the tuner, sweep and marker generator for channel 13 frequencies and adjust A54 to place the sound marker in the proper position. Then repeat step 23.
			207MC (10MC Swp)	209.75MC	12			
			201MC (10MC Swp)	203.75MC	11			
			195MC (10MC Swp)	197.75MC	10			
			189MC (10MC Swp)	191.75MC	9			
			183MC (10MC Swp)	185.75MC	8			
			177MC (10MC Swp)	179.75MC	7			
25.	"	"	85MC (10MC Swp)	87.75MC	6	"	A55	Adjust to place sound marker in trap notch as in Fig. 10. A55 thru A59 are adjusted by compressing and expanding coil turns.
			79MC (10MC Swp)	81.75MC	5		A56	
			69MC (10MC Swp)	71.75MC	4		A57	
			63MC (10MC Swp)	65.75MC	3		A58	
			57MC (10MC Swp)	59.75MC	2		A59	

MOTOROLA MODELS Y21K53B, BA, M, MA, Y21K55B, BA, M, MA, Y21T32B, BA, CH, CHA, MGA, Y21T34B, BA, M, MA, Y24K13B, M, Y24T5BG, MG, 21K35B, BA, M, MA, 21K55B, BA, M, MA, 21T32B, BA, CH, CHA, MGA, 21T34B, BA, M, MA, 24K13B, M, 24T5BG, MG (Ch. TS-537, Y, TTS-537, Y, WTS-537, Y)



CHASSIS TOP VIEW

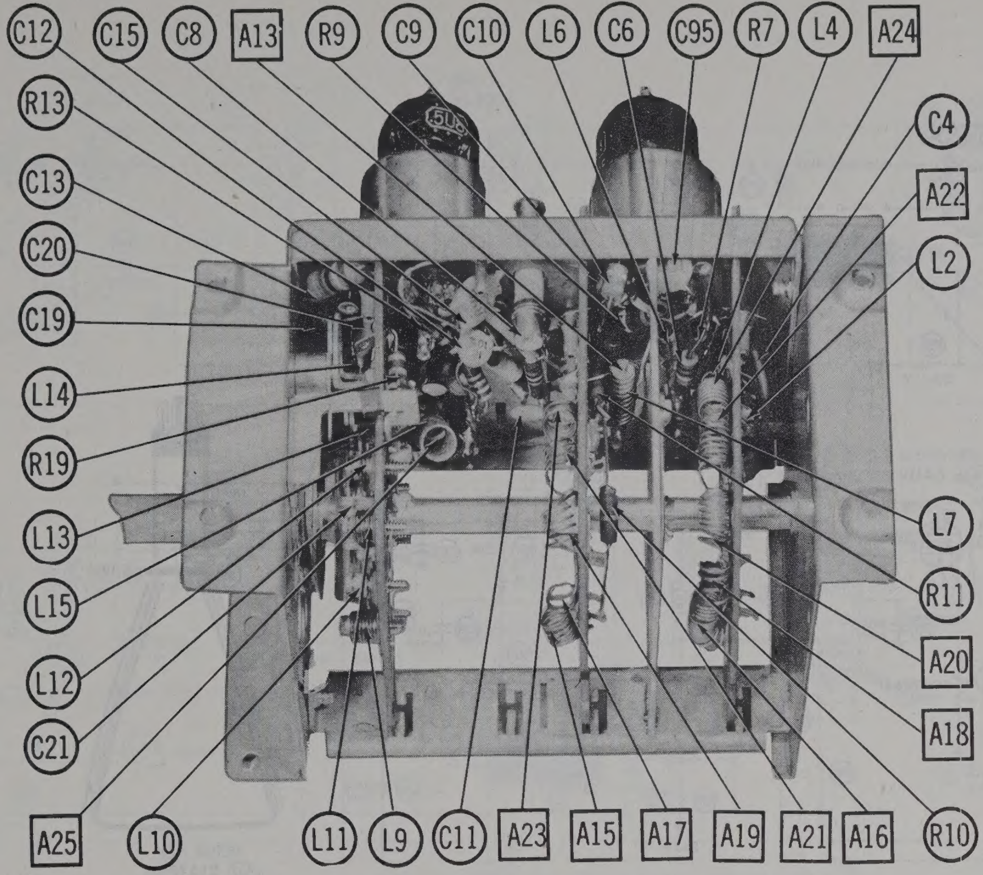
SET 345 FOLDER 9

ALIGNMENT INSTRUCTIONS (cont)

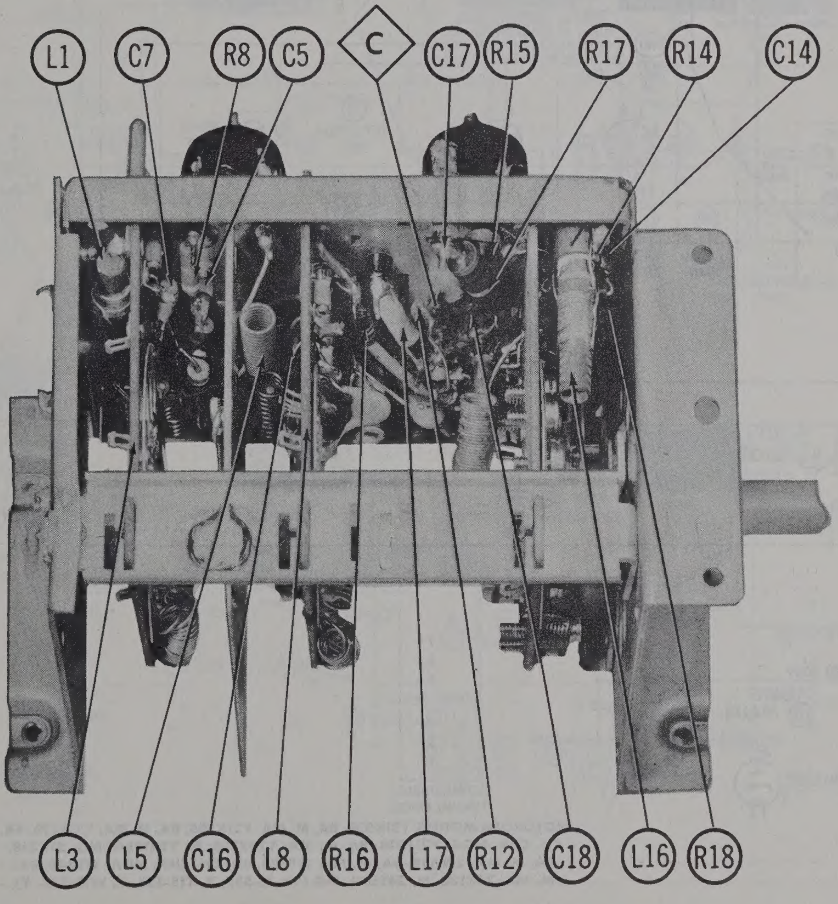
VHF OSCILLATOR ALIGNMENT FOR TUNERS TT77 AND TT78

Connect the bias as under "Video IF Alignment".
Connect the synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.
The sweep generator output lead should be terminated with its characteristic impedance, usually 50 ohms.
Set the fine tuning control to the mid-position of its range.
Use only enough sweep generator output to provide usable pattern on scope.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
23.	Two 120Ω Carbon Resistors	Across VHF antenna terminals with 120Ω in each lead.	195MC (10MC Swp)	197.75MC	10	Vert. Amp. thru 47K to point Ⓒ. Low side to chassis.	A53	Adjust to place sound marker in trap notch as in Fig. 10.
24.	"	"	213MC (10MC Swp)	215.75MC	13		A54	Check channels 7 thru 13 noting if the sound marker for each channel falls just above the trap notch. If more than 40 degrees rotation of the fine tuning is required to place the sound marker in the proper position on any high channel, set the tuner, sweep and marker generator for channel 13 frequencies and adjust A54 to place the sound marker in the proper position. Then repeat step 23.
			207MC (10MC Swp)	209.75MC	12			
			201MC (10MC Swp)	203.75MC	11			
			195MC (10MC Swp)	197.75MC	10			
			189MC (10MC Swp)	191.75MC	9			
			183MC (10MC Swp)	185.75MC	8			
			177MC (10MC Swp)	179.75MC	7			
25.	"	"	85MC (10MC Swp)	87.75MC	6	"	A55	Adjust to place sound marker in trap notch as in Fig. 10. A55 thru A59 are adjusted by compressing and expanding coil turns.
			79MC (10MC Swp)	81.75MC	5		A56	
			69MC (10MC Swp)	71.75MC	4		A57	
			63MC (10MC Swp)	65.75MC	3		A58	
			57MC (10MC Swp)	59.75MC	2		A59	


C12
C15
C8
A13
R9
C9
C10
L6
C6
C95
R7
L4
A24
5U6
R13
C13
C20
C19
L14
R19
L13
L15
L12
C21
C4
A22
L2
L7
R11
A20
A18
A25
L10
L11
L9
C11
A23
A15
A17
A19
A21
A16
R10

RF TUNER-RIGHT SIDE


L1
C7
R8
C5
C
C17
R15
R17
R14
C14
L3
L5
C16
L8
R16
L17
R12
C18
L16
R18

RF TUNER-LEFT SIDE

ALIGNMENT INSTRUCTIONS

ALIGNMENT INSTRUCTIONS—READ CAREFULLY BEFORE ATTEMPTING ALIGNMENT

The high voltage shock hazard may be eliminated by removing the yoke plug and connecting an 1800Ω (40 watt) resistor from TP-3 of the service test receptacle to ground.

VIDEO IF ALIGNMENT

Connect the negative lead of 6 volt bias supply to TP-5 of the service test receptacle. Connect the positive lead to chassis.
Disable the tuner oscillator by connecting a wire from pin 9 (grid) of the oscillator (V2B) to chassis and turning the channel selector to channel 13.
Set the contrast control fully counter clockwise. If transmitted signals interfere with alignment disconnect the receivers antenna and connect a short across the antenna terminals.
Connect the synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.
The sweep generator output lead should be terminated with its characteristic impedance, usually 50 ohms.
Use only enough sweep generator output to provide usable pattern on scope.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
1.	.001MFD	High side to point ⟨B⟩. Low side to chassis.	44MC (10MC Swp)	42.25MC	13	Vert. Amp. thru 47K to point ⟨A⟩. Low side to chassis.	A1	Preset A8 by turning into the tuner a few turns so that it is out of the IF response curve bandpass. Be careful not to turn the slug too far or it will fall into the tuner. Adjust A1 to place 42.25MC marker in proper position on response curve as in Fig. 1. Correct position of adjustment is with core farthest from chassis end of coil.
2.	"	"	"	45.75MC	"	"	A2, A3	Adjust A2 to place 45.75MC marker on response curve as in Fig. 1. Correct adjustment of A2 is with core farthest from chassis end of coil. Adjust A3 to position center portion of curve for MINIMUM tilt and dip. Correct adjustment of A3 is with core nearest chassis end of coil.
3.	"	High side to point ⟨C⟩. Low side to chassis.	"	41.4MC 42.75MC 45.75MC	"	"	A4, A5, A6, A7	Adjust A4, A5 and A6 to place markers (42.75MC and 45.75MC) as shown in Fig. 2. Increase generator output to observe trap notch. Adjust A7 to place 41.4MC marker in trap notch as in Fig. 2.
4.	"	"	"	"	"	"	A8	Adjust A8 for response curve similar to Fig. 3 with correct marker positions.

SOUND IF ALIGNMENT (For Strong Signal Areas)

1. Connect the negative lead of the VTVM to point ⟨D⟩. Connect the positive lead to chassis.
2. Connect the antenna and tune in a TV station.
3. Set the contrast control fully clockwise.
4. Set the volume control to normal.
5. Adjust A9 for maximum meter deflection. There are two points of tuning A9. Use the point with the higher reading.
6. Reduce the signal at the antenna (using an attenuator) until the picture has been weakened considerably.
7. Adjust A10 and A11 for best signal to noise ratio by listening to the sound. If the signal is too strong, exact tuning will be difficult. The proper adjustment of A10 is with core nearest chassis. The proper adjustment for A11 is with the core farthest from chassis. Readjust A10 for best signal to noise ratio.

SOUND IF ALIGNMENT (For Weak Signal Areas)

1. Connect the negative lead of a VTVM to point ⟨D⟩. Connect positive lead to chassis.
2. Using the maximum available signal, roughly align A9, A10 and A11 for maximum meter deflection. There are two points of tuning for A9. Use the one with the highest reading.
3. Readjust A9 for MINIMUM sound distortion.
4. Using the weakest signal possible, adjust A10 for best signal to noise ratio.
5. Using a weak signal, adjust A11 for best signal to noise ratio.
6. Repeat steps 1 thru 5 several times for optimum results.

4.5MC TRAP ADJUSTMENT

Tune in a TV station and advance contrast control. Adjust fine tuning until 4.5MC beat (graininess) appears in picture.
Adjust A12 for MINIMUM beat pattern in picture. If two points of minimum appear, use the position with the slug farthest out of the coil.

VHF RF AND MIXER ALIGNMENT FOR TUNER TT86, TT86A AND TT86Y

Connect a clip lead from the tuner AGC line to chassis.
Remove the tuner cover. Set the scope gain so that the scope provides a two to three inch deflection with an input of .7 to 1 volt.
If a separate marker generator is used, loosely couple to the antenna input receptacle. Preset A37 by clockwise rotation until its effect is out of the tuners bandpass on channel 2. Preset A14 half-way between its limits of rotation. Preset A13 so that the slug is one-half out of the coil.
Connect the synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.
The sweep generator output lead should be terminated with its characteristic impedance, usually 50 ohms.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
5.	Two 120Ω Carbon Resistors	Across antenna terminals with 120Ω in each lead.	213MC (10MC Swp)	211.25MC 215.75MC	13	Vert. Amp. thru 47K to point ⟨C⟩. Low side to chassis.	A13	Adjust for maximum amplitude and marker positions as shown in Fig. 4.
6.	"	"	177MC (10MC Swp)	175.25MC 179.75MC	7	"	A14	Adjust for maximum amplitude and marker positions as shown in Fig. 4. Repeat steps 5 and 6 to obtain best results.
7.	"	"	85MC (10MC Swp)	83.25MC 87.75MC	6	"	A15, A16	Adjust A15 for proper marker positions. Adjust A16 for maximum gain and proper tilt. (See Fig. 5.)
8.	"	"	79MC (10MC Swp)	77.25MC 81.75MC	5	"	A17, A18	Adjust A17 for proper marker positions as in Fig. 5. Adjust A18 for maximum gain and proper tilt.
9.	"	"	69MC (10MC Swp)	67.25MC 71.75MC	4	"	A19, A20	Adjust A19 for proper marker positions as in Fig. 5. Adjust A20 for maximum gain and proper tilt.
10.	"	"	63MC (10MC Swp)	61.25MC 65.75MC	3	"	A21, A22	Adjust A21 for proper marker positions as in Fig. 5. Adjust A22 for maximum gain and proper tilt.
11.	"	"	57MC (10MC Swp)	55.25MC 59.75MC	2	"	A23, A24	Adjust A23 for proper marker positions as in Fig. 5. Adjust A24 for maximum gain and proper tilt.

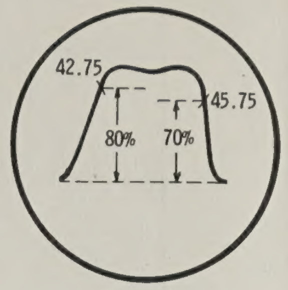


FIG. 1

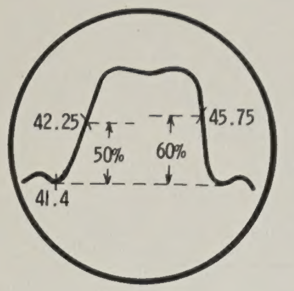


FIG. 2

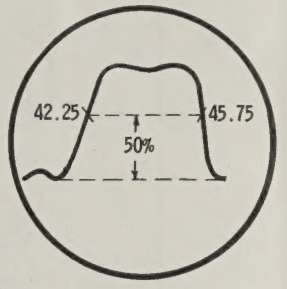


FIG. 3

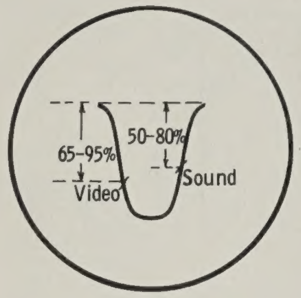


FIG. 4

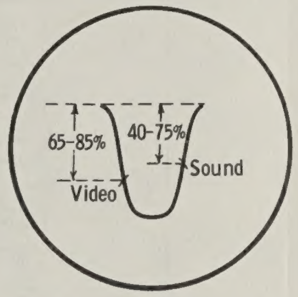


FIG. 5

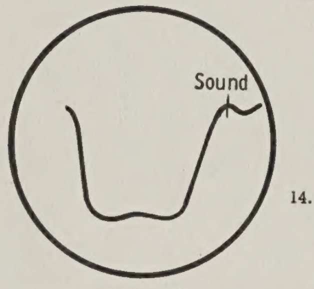


FIG. 6

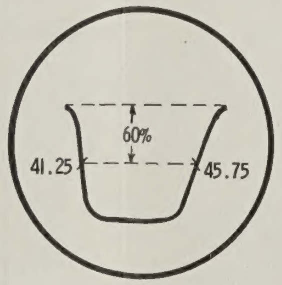


FIG. 7

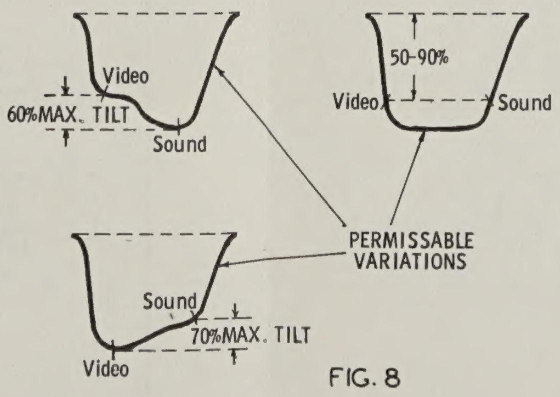


FIG. 8

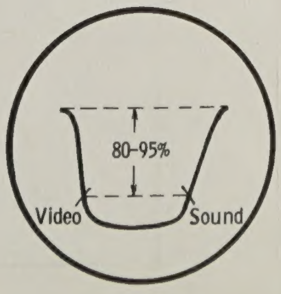


FIG. 9

Permissable placement of sound markers with tuner shield removed.

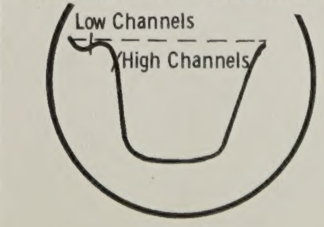


FIG. 10

VHF OSCILLATOR ALIGNMENT FOR TUNERS TT86, TT86A AND TT86Y

Replace the tuner cover. Connect bias as under "Video IF Alignment".
Connect the synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.
The sweep generator output lead should be terminated with its characteristic impedance, usually 50 ohms.
Set the fine tuning control to the mid-position of its range.
Use only enough sweep generator output to provide usable pattern on scope.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
12.	Two 120Ω Carbon Resistors	Across antenna terminals with 120Ω in each lead.	213MC (10MC Swp)	215.75MC	13	Vert. Amp. thru 47K to point ⟨A⟩. Low side to chassis.	A25	Adjust to place sound marker in trap notch as in Fig. 6.
			207MC (10MC Swp)	209.75MC	12		A26	
			201MC (10MC Swp)	203.75MC	11		A27	
			195MC (10MC Swp)	197.75MC	10		A28	
			189MC (10MC Swp)	191.75MC	9		A29	
			183MC (10MC Swp)	185.75MC	8		A30	
			177MC (10MC Swp)	179.75MC	7		A31	
			85MC (10MC Swp)	87.75MC	6		A32	
			79MC (10MC Swp)	81.75MC	5		A33	
			69MC (10MC Swp)	71.75MC	4		A34	
			63MC (10MC Swp)	65.75MC	3		A35	
			57MC (10MC Swp)	59.75MC	2		A36	

IF TRAP ADJUSTMENT

Connect the synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.
The sweep generator output lead should be terminated with its characteristic impedance, usually 50 ohms.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
13.	Two 120Ω Carbon Resistors	Across VHF antenna terminals with 120Ω in each lead.	44MC (10MC Swp)	44MC	2	Vert. Amp. thru 47K to point ⟨A⟩. Low side to chassis.	A37	Adjust for MINIMUM amplitude at 44MC marker.

UHF IF ALIGNMENT

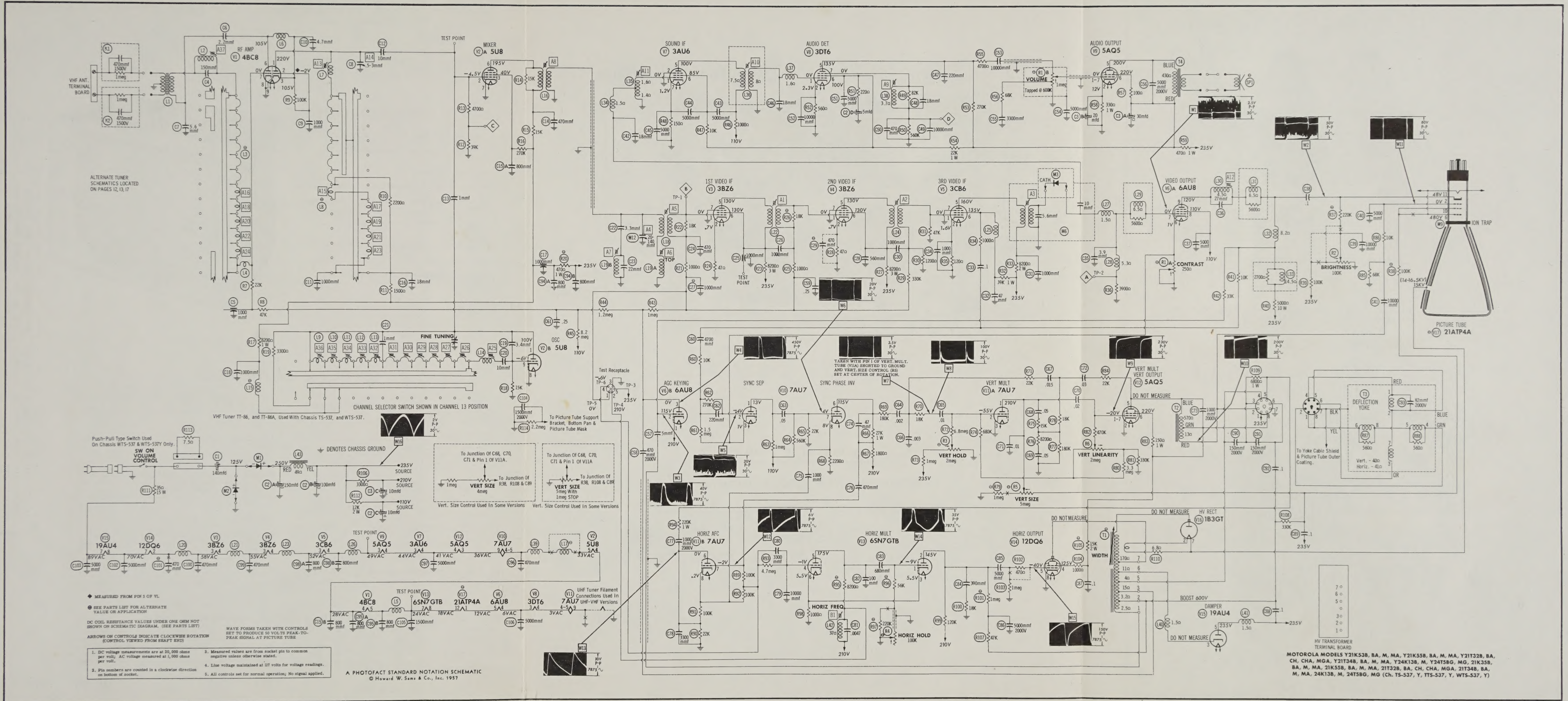
Unplug the UHF tuner output cable from the VHF tuner.
Connect the synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.
The sweep generator output lead should be terminated with its characteristic impedance, usually 50 ohms.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
14.	Two 120Ω Carbon Resistors	Across UHF antenna terminals with 120Ω in each lead.	44MC (10MC Swp)	41.25MC 45.75MC	UHF	Vert. Amp. thru 47K to point ⟨C⟩. Low side to chassis.	A38, A39	Adjust A38 for proper marker positions as in Fig. 7. Adjust A39 for maximum gain and proper tilt.

VHF RF AND MIXER ALIGNMENT FOR TUNERS TT77 AND TT78

Adjust scope gain to produce 2 inch deflectinn with an input voltage of .75 volts.
Connect a clip lead from the ungrounded side of C61 to chassis. This grounds the AGC line. If the sweep generator has no built-in marker, loosely couple a separate marker generator to the antenna terminals.
Connect the synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.
The sweep generator output lead should be terminated with itscharacteristicimpedance, usually 50 ohms.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
15.	Two 120Ω Carbon Resistors	Across VHF antenna terminals with 120Ω in each lead.	213MC (10MC Swp)	211.25MC 215.75MC	13	Vert. Amp. thru 47K to point ⟨A⟩. Low side to chassis.	A40, A41	Adjust A40 and A41 for maximum amplitude and response similar to Fig. 8.
16.	"	"	177MC (10MC Swp)	175.25MC 179.75MC	7	"	A42	Adjust for maximum amplitude, correct tilt and correct marker position as in Fig. 8.
17.	"	"	207MC (10MC Swp)	205.25MC 209.75MC	12	"		Check response curve on each channel. If response is not within limits on each channel, repeat steps 15 and 16. If necessary, make compromise adjustments of A40 and A41.
			201MC (10MC Swp)	199.25MC 203.75MC	11			
			195MC (10MC Swp)	193.25MC 197.75MC	10			
			189MC (10MC Swp)	187.25MC 191.75MC	9			
			183MC (10MC Swp)	181.25MC 185.75MC	8			
18.	"	"	85MC (10MC Swp)	83.25MC 87.75MC	6	"	A43, A44	Adjust A43 and A44 for maximum gain, proper tilt and markers in proper marker positions as in Fig. 9.
19.	"	"	79MC (10MC Swp)	77.25MC 81.75MC	5	"	A45, A46	Adjust A45 and A46 in that order for maximum gain, proper tilt and correct marker positions as in Fig. 9.
20.	"	"	69MC (10MC Swp)	67.25MC 71.75MC	4	"	A47, A48	Adjust for maximum gain, proper tilt and correct marker positions as in Fig. 9.
21.	"	"	63MC (10MC Swp)	61.25MC 65.75MC	3	"	A49, A50	"
22.	"	"	57MC (10MC Swp)	55.25MC 59.75MC	2	"	A51, A52	Adjust for maximum gain, proper tilt and correct marker positions as in Fig. 9. Remove clip lead from AGC line.


VHF ANT. TERMINAL BOARD
RF AMP V1 4BC8
MIXER V2A 5U8
OSC V2B 5U8
TEST POINT
ALTERNATE TUNER SCHEMATICS LOCATED ON PAGES 12, 13, 17
FINE TUNING
CHANNEL SELECTOR SWITCH SHOWN IN CHANNEL 13 POSITION
VHF Tuner TT-86, and TT-86A, Used With Chassis TS-537, and WTS-537.
SOUND IF V7 3AU6
AUDIO DET V8 3DT6
AUDIO OUTPUT V9 5AQ5
VOLUME Tapped @ 600K
1ST VIDEO IF V3 3BZ6
2ND VIDEO IF V4 3BZ6
3RD VIDEO IF V5 3CB6
VIDEO OUTPUT V6A 6AU8
CONTRAST
BRIGHTNESS
ION TRAP
PICTURE TUBE V17 21ATP4A
AGC KEYING V6B 6AU8
SYNC SEP V10 7AU7
SYNC PHASE INV
VERT MULT V11A 7AU7
VERT MULT VERT OUTPUT V12 5AQ5
VERT HOLD
VERT LINEARITY
VERT SIZE
DO NOT MEASURE
DEFLECTION YOKE
To Yoke Cable Shield & Picture Tube Outer Coating.
TAKEN WITH PIN 1 OF VERT. MULT. TUBE (V11A) SHORTED TO GROUND AND VERT. SIZE CONTROL (R5) SET AT CENTER OF ROTATION.
Test Receptacle
To Picture Tube Support Bracket, Bottom Pan & Picture Tube Mask
Push-Pull Type Switch Used On Chassis WTS-537 & WTS-537Y Only.
SW ON VOLUME CONTROL
DENOTES CHASSIS GROUND
235V SOURCE
210V SOURCE
110V SOURCE
Vert. Size Control Used In Some Versions
HORIZ AFC V11B 7AU7
HORIZ MULT V13 6SN7GTB
HORIZ FREQ
HORIZ HOLD
HORIZ OUTPUT V14 12DQ6
WIDTH
HV RECT V16 1B3GT
DAMPER V15 19AU4
BOOST 600V
HV TRANSFORMER TERMINAL BOARD
UHF Tuner Filament Connections Used In UHF-VHF Versions

◆ MEASURED FROM PIN 3 OF V1.

⊖ SEE PARTS LIST FOR ALTERNATE VALUE OR APPLICATION

DC COIL RESISTANCE VALUES UNDER ONE OHM NOT SHOWN ON SCHEMATIC DIAGRAM. (SEE PARTS LIST)

ARROWS ON CONTROLS INDICATE CLOCKWISE ROTATION (CONTROL VIEWED FROM SHAFT END)

WAVE FORMS TAKEN WITH CONTROLS SET TO PRODUCE 50 VOLTS PEAK-TO-PEAK SIGNAL AT PICTURE TUBE

1. DC voltage measurements are at 20,000 ohms per volt; AC voltage measured at 1,000 ohms per volt.
2. Pin numbers are counted in a clockwise direction on bottom of socket.
3. Measured values are from socket pin to common negative unless otherwise stated.
4. Line voltage maintained at 117 volts for voltage readings.
5. All controls set for normal operation; No signal applied.

A PHOTOFACT STANDARD NOTATION SCHEMATIC

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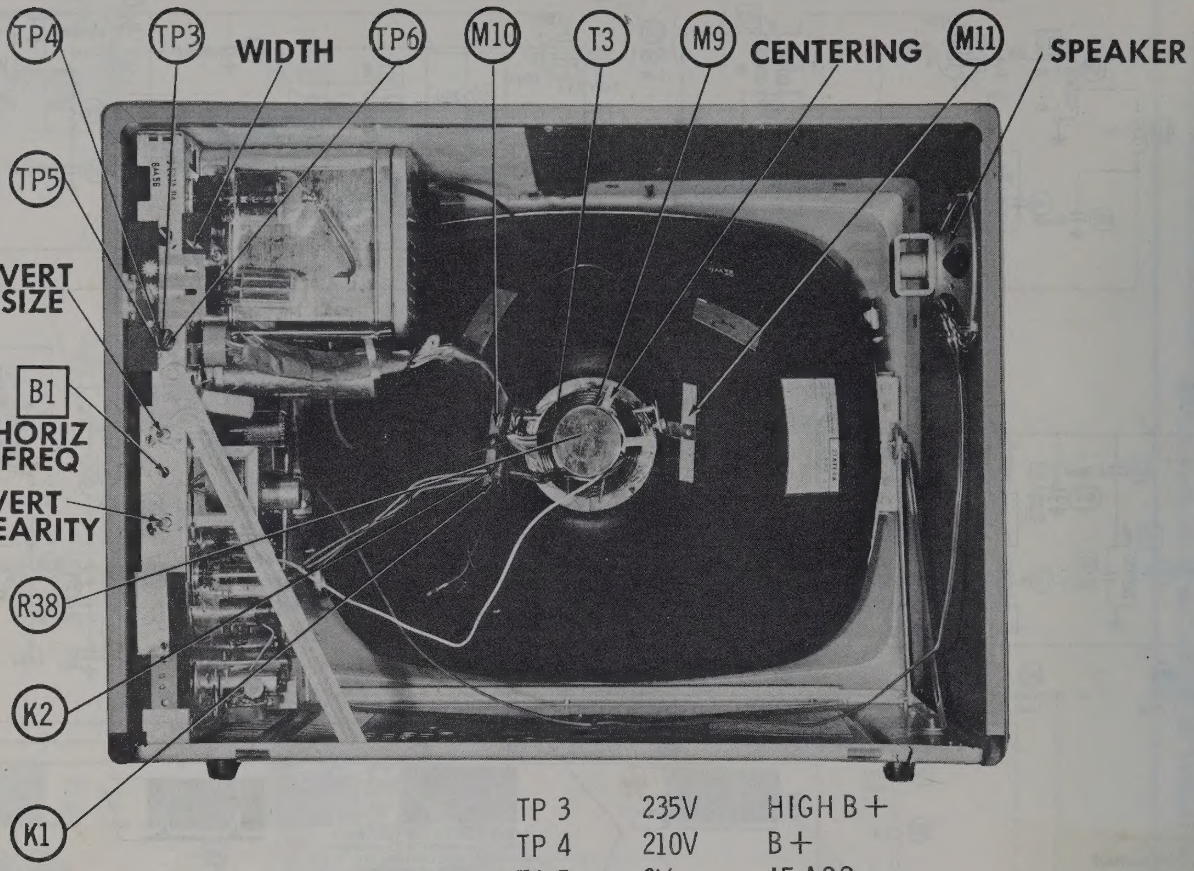
MOTOROLA MODELS Y21K53B, BA, M, MA, Y21K55B, BA, M, MA, Y21T32B, BA, CH, CHA, MGA, Y21T34B, BA, M, MA, Y24K13B, M, Y24T5BG, MG, 21K35B, BA, M, MA, 21K55B, BA, M, MA, 21T32B, BA, CH, CHA, MGA, 21T34B, BA, M, MA, 24K13B, M, 24T5BG, MG (Ch. TS-537, Y, TTS-537, Y, WTS-537, Y)



TP 3	235V	HIGH B+
TP 4	210V	B+
TP 5	0V	IF AGC
TP 6	-.6V	HORIZ. AFC

CABINET—REAR VIEW

HORIZONTAL SWEEP CIRCUIT ADJUSTMENTS

Turn the set on and tune in a TV station, preferably with a test pattern. Adjust the brightness and contrast controls for a normal picture.

1. Short out the AFC voltage by connecting a clip lead from TP-6 of the service test receptacle to chassis. Connect a .1MFD, 400 volt capacitor to TP-4 of the service test receptacle. Connect the other side of the capacitor to chassis.

2. Adjust the horizontal hold control to the point where the picture remains stable horizontally.

3. Remove the capacitor from TP-4 of the service test receptacle and adjust the horizontal frequency slug (B1) to the point where the picture remains stable horizontally.

4. Remove the clip lead between TP-6 of the service test receptacle and chassis. Adjust the horizontal hold control until the picture remains in sync.

Adjust the horizontal size (located on the rear of the chassis) for a picture slightly larger than necessary to fill the picture mask horizontally.

PHOTOFACT* Folder

*TRADE MARK

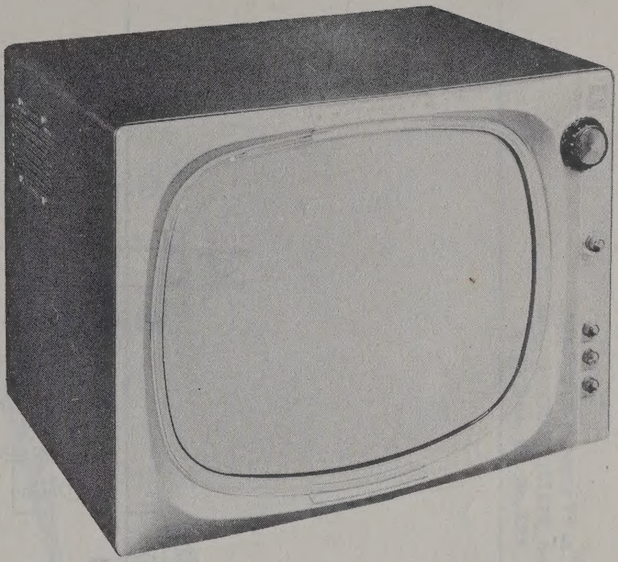
MOTOROLA MODELS Y21K37B, BA, BR, BRA, Y21K39, B, Y21K40, B, Y21T26B, BA, BR, BRA, CH, CHA, Y21T27B, MA, PK, Y21T28, B, 21K37B, BA, BR, BRA, 21K39, B, 21K40, B, 21T26B, BA, BR, BRA, CH, CHA, 21T27B, MA, PK, 21T28, B (Ch. TS-534, Y, YB)

DISASSEMBLY INSTRUCTIONS

CABINET REMOVAL

1. Remove 1 metal screws. Remove rear cover.
2. Disconnect speaker plug.
3. Remove 2 metal screws from "L" shaped tie down strip at the upper rear portion of the chassis.
4. Remove 4 metal screws from safety glass retainer plates and remove safety glass.
5. Remove 2 metal screws from behind retainer plate.
6. Remove 6 metal screws holding bottom pan to cabinet.
7. Remove cabinet shell from chassis bottom pan.
8. Remove 4 speaker nuts. Remove speaker.

NOTE: If it is necessary to remove the chassis for servicing, it is also necessary to remove the speaker. The speaker is the electro-magnetic type and must be connected for proper operation.



CHASSIS

TS-534, TS-534Y, TS-534YB, VTS-534, VTS-534Y, WTS-534, WTS-534Y

SERVICING IN THE FIELD

TUNER OSCILLATOR ADJUSTMENTS

For touch-up adjustment of VHF tuner oscillator adjustments, it is necessary to remove the chassis from the cabinet. (See disassembly instructions). (Also see alignment instructions on pages 6 and 7).

PICTURE TUBE SAFETY GLASS CLEANING

To clean safety glass, remove 4 metal screws from glass retainers at the top and bottom edges of the safety glass. Remove retainer plates and safety glass. Use extreme caution when removing safety glass.

PICTURE TUBE REMOVAL

For picture tube removal it is necessary to remove chassis. (See disassembly instructions).

SERVICE ADJUSTMENT LOCATION

See tube placement chart on page 5.

HORIZONTAL OSCILLATOR FIELD ADJUSTMENT

The horizontal oscillator may be adjusted from the rear of chassis. Set the horizontal hold control at the center of its range and adjust the horizontal oscillator slug (B1) until picture synchronizes horizontally.

SOUND IF DETECTOR BUZZ ADJUSTMENT

To eliminate sound IF detector buzz, adjust the ratio detector secondary (A11) located on top of chassis.

CENTERING

Centering is accomplished mechanically by adjusting two magnetic rings around the neck of the picture tube, located flush against the deflection yoke. Rotate the two rings around the neck of the tube until the picture is properly centered.

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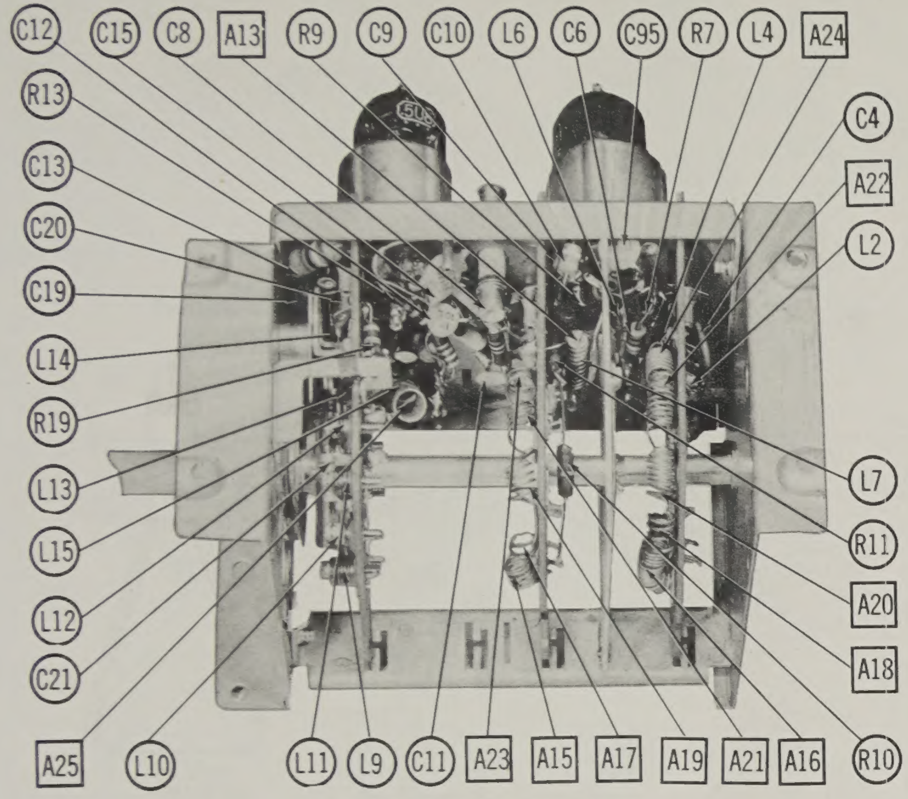
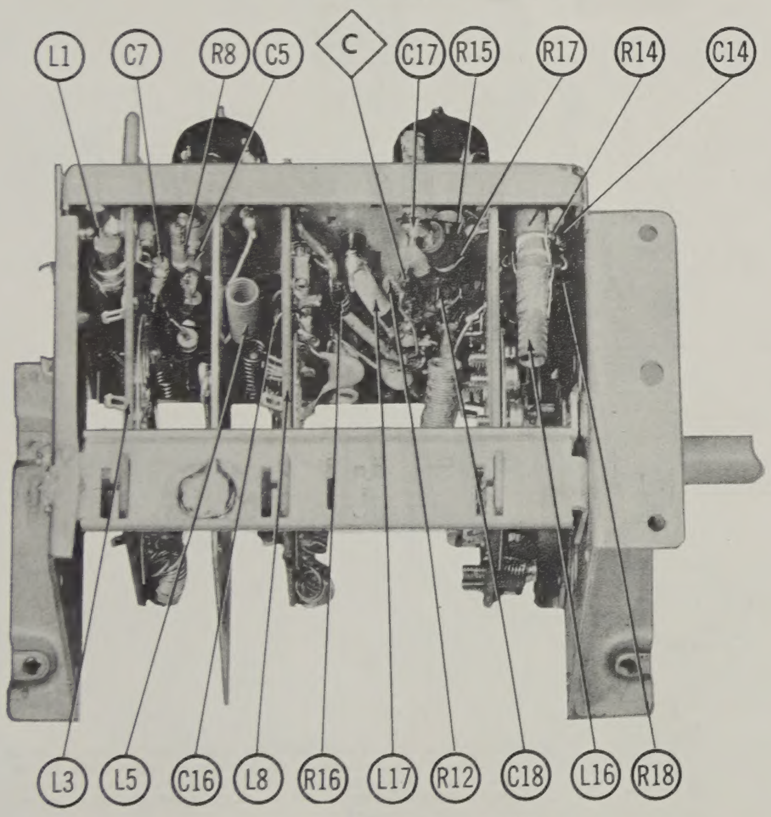
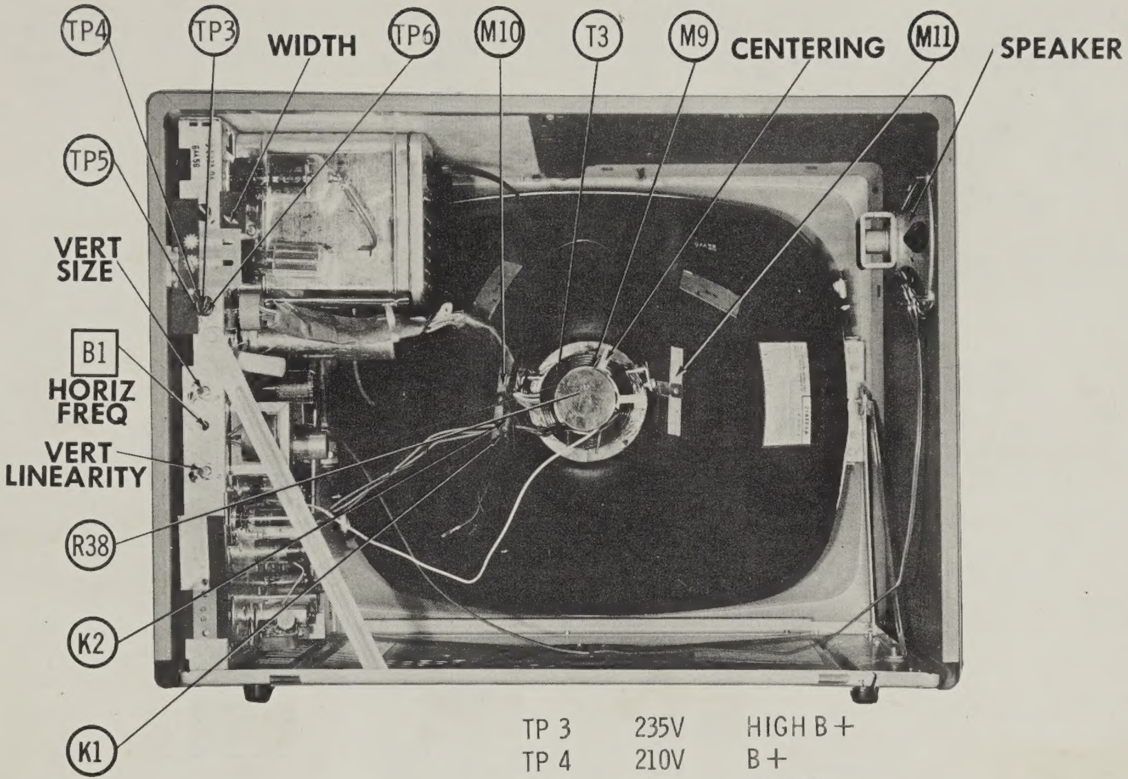

C12
C15
C8
A13
R9
C9
C10
L6
C6
C95
R7
L4
A24
R13
C13
C20
C19
L14
R19
L13
L15
L12
C21
A25
L10
C4
A22
L2
L7
R11
A20
A18
R10
L11
L9
C11
A23
A15
A17
A19
A21
A16

RF TUNER-RIGHT SIDE


L1
C7
R8
C5
C
C17
R15
R17
R14
C14
L3
L5
C16
L8
R16
L17
R12
C18
L16
R18

RF TUNER-LEFT SIDE


TP4
TP3
WIDTH
TP6
M10
T3
M9
CENTERING
M11
SPEAKER
TP5
VERT SIZE
B1
HORIZ FREQ
VERT LINEARITY
R38
K2
K1

TP 3	235V	HIGH B+
TP 4	210V	B+
TP 5	0V	IF AGC
TP 6	-.6V	HORIZ. AFC

CABINET—REAR VIEW

HORIZONTAL SWEEP CIRCUIT ADJUSTMENTS

Turn the set on and tune in a TV station, preferably with a test pattern. Adjust the brightness and contrast controls for a normal picture.

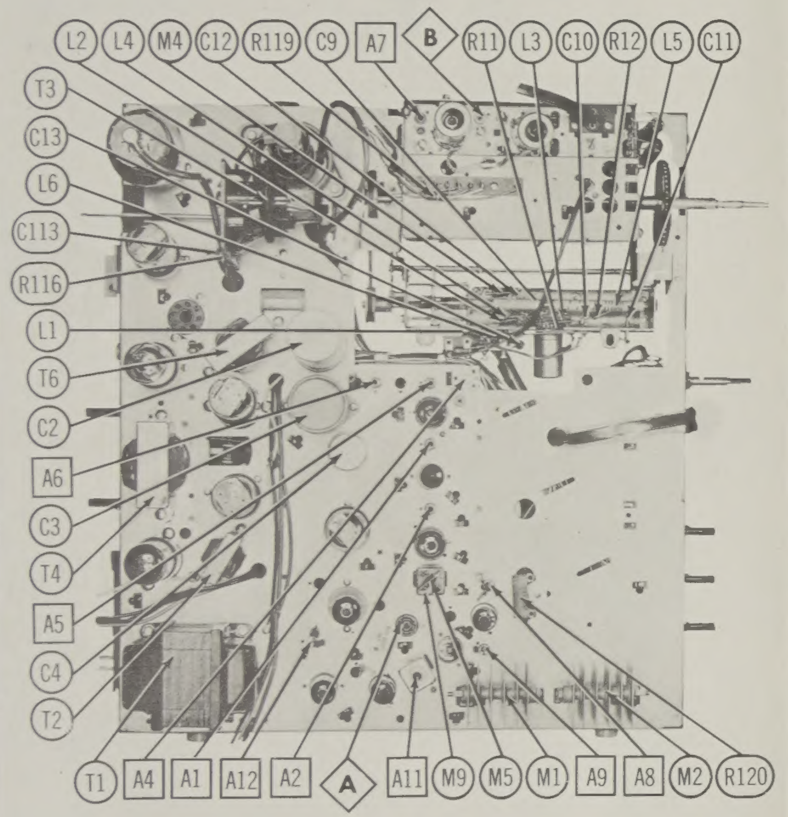
1. Short out the AFC voltage by connecting a clip lead from TP-6 of the service test receptacle to chassis. Connect a .1MFD, 400 volt capacitor to TP-4 of the service test receptacle. Connect the other side of the capacitor to chassis.

2. Adjust the horizontal hold control to the point where the picture remains stable horizontally.

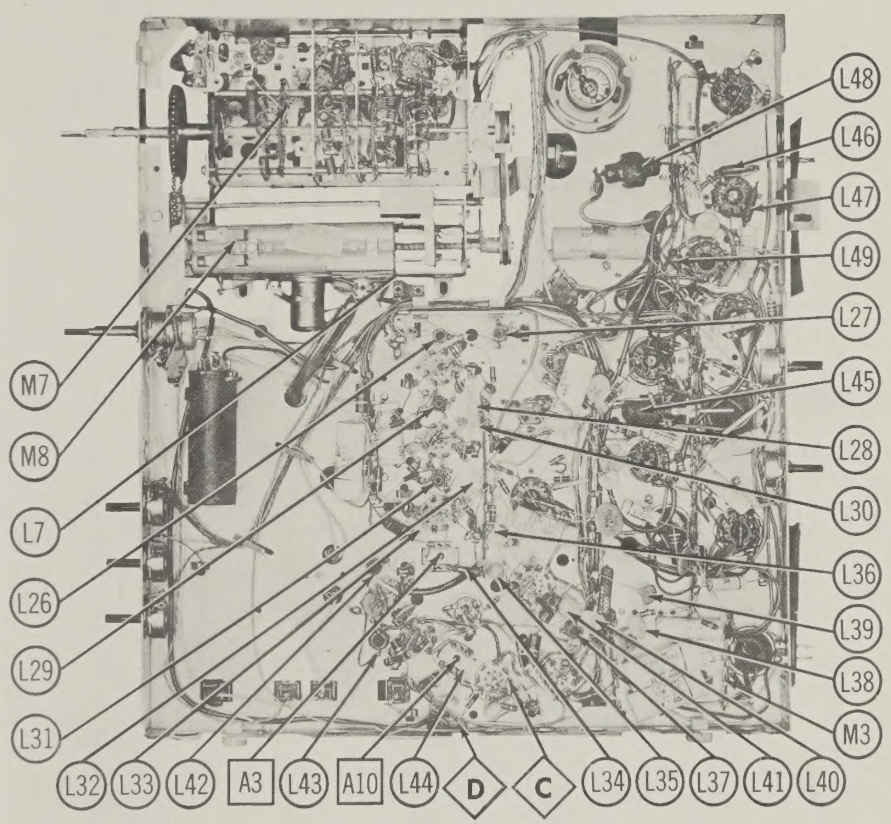
3. Remove the capacitor from TP-4 of the service test receptacle and adjust the horizontal frequency slug (B1) to the point where the picture remains stable horizontally.

4. Remove the clip lead between TP-6 of the service test receptacle and chassis. Adjust the horizontal hold control until the picture remains in sync.

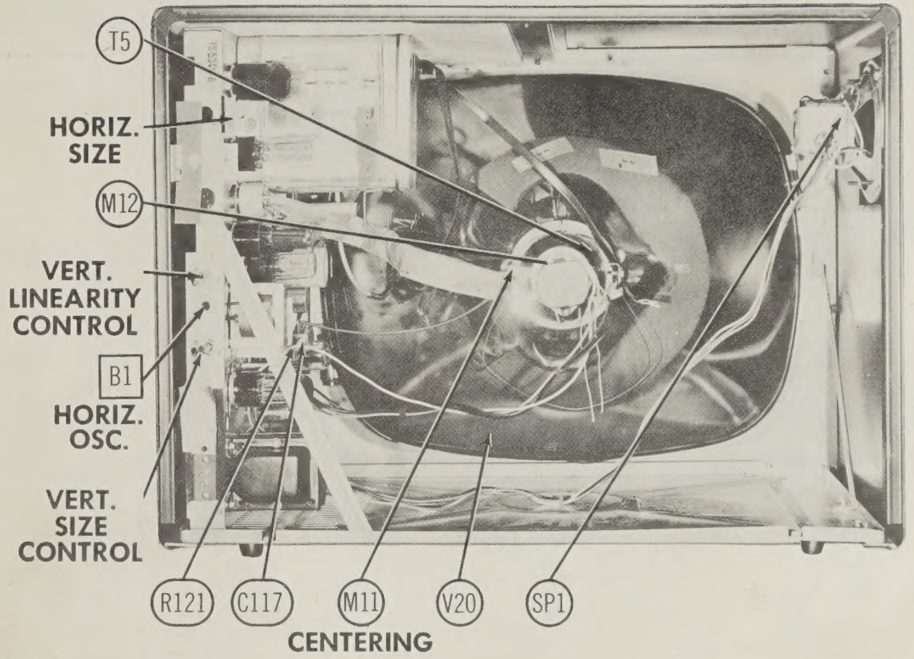
Adjust the horizontal size (located on the rear of the chassis) for a picture slightly larger than necessary to fill the picture mask horizontally.



CHASSIS TOP VIEW



CHASSIS BOTTOM VIEW-TRANS., AND ALIGNMENT IDENTIFICATION



CABINET—REAR VIEW

HORIZONTAL SWEEP CIRCUIT ADJUSTMENTS

Turn the set on and tune in a TV station, preferably a test pattern. Adjust the brightness and contrast controls for a normal picture.

1. Short out the AFC voltage and shunt the horizontal oscillator coil (L46) to ground (chassis) with a .1MFD, 400V capacitor. This may be done with the chassis in cabinet by using the three pin sockets on rear of chassis labeled "Test Receptacle".

2. Adjust the horizontal hold control to the point where picture remains stable horizontally.

3. Remove .1MFD capacitor from L46 and adjust the horizontal oscillator slug (B1) to the point where picture remains stable horizontally.

4. Remove short from AFC voltage and adjust the horizontal hold control until picture remains in sync over approximately 30 degrees of its range while switching off channel and back again.

Adjust the horizontal size control (located just above the left rear side of the chassis) for a picture slightly wider than necessary to fill the picture mask horizontally.

PHOTOFACT* Folder

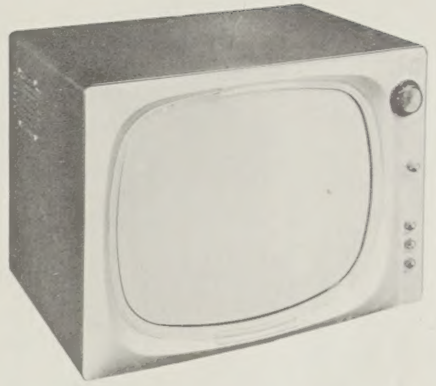
MOTOROLA MODELS Y21K37B, BA, BR, BRA, Y21K39, B, Y21K40, B, Y21T26B, BA, BR, BRA, CH, CHA, Y21T27B, MA, PK, Y21T28, B, 21K37B, BA, BR, BRA, 21K39, B, 21K40, B, 21T26B, BA, BR, BRA, CH, CHA, 21T27B, MA, PK, 21T28, B (Ch. TS-534, Y, YB)

DISASSEMBLY INSTRUCTIONS

CABINET REMOVAL

1. Remove 1 metal screws. Remove rear cover.
2. Disconnect speaker plug.
3. Remove 2 metal screws from "L" shaped tie down strip at the upper rear portion of the chassis.
4. Remove 4 metal screws from safety glass retainer plates and remove safety glass.
5. Remove 2 metal screws from behind retainer plate.
6. Remove 6 metal screws holding bottom pan to cabinet.
7. Remove cabinet shell from chassis bottom pan.
8. Remove 4 speaker nuts. Remove speaker.

NOTE: If it is necessary to remove the chassis for servicing, it is also necessary to remove the speaker. The speaker is the electro-magnetic type and must be connected for proper operation.



CHASSIS

TS-534, TS-534Y, TS-534YB, VTS-534,
VTS-534Y, WTS-534, WTS-534Y

SERVICING IN THE FIELD

TUNER OSCILLATOR ADJUSTMENTS

For touch-up adjustment of VHF tuner oscillator adjustments, it is necessary to remove the chassis from the cabinet. (See disassembly instructions). (Also see alignment instructions on pages 6 and 7).

PICTURE TUBE SAFETY GLASS CLEANING

To clean safety glass, remove 4 metal screws from glass retainers at the top and bottom edges of the safety glass. Remove retainer plates and safety glass. Use extreme caution when removing safety glass.

PICTURE TUBE REMOVAL

For picture tube removal it is necessary to remove chassis. (See disassembly instructions).

SERVICE ADJUSTMENT LOCATION

See tube placement chart on page 5.

HORIZONTAL OSCILLATOR FIELD ADJUSTMENT

The horizontal oscillator may be adjusted from the rear of chassis. Set the horizontal hold control at the center of its range and adjust the horizontal oscillator slug (B1) until picture synchronizes horizontally.

SOUND IF DETECTOR BUZZ ADJUSTMENT

To eliminate sound IF detector buzz, adjust the ratio detector secondary (A11) located on top of chassis.

CENTERING

Centering is accomplished mechanically by adjusting two magnetic rings around the neck of the picture tube, located flush against the deflection yoke. Rotate the two rings around the neck of the tube until the picture is properly centered.

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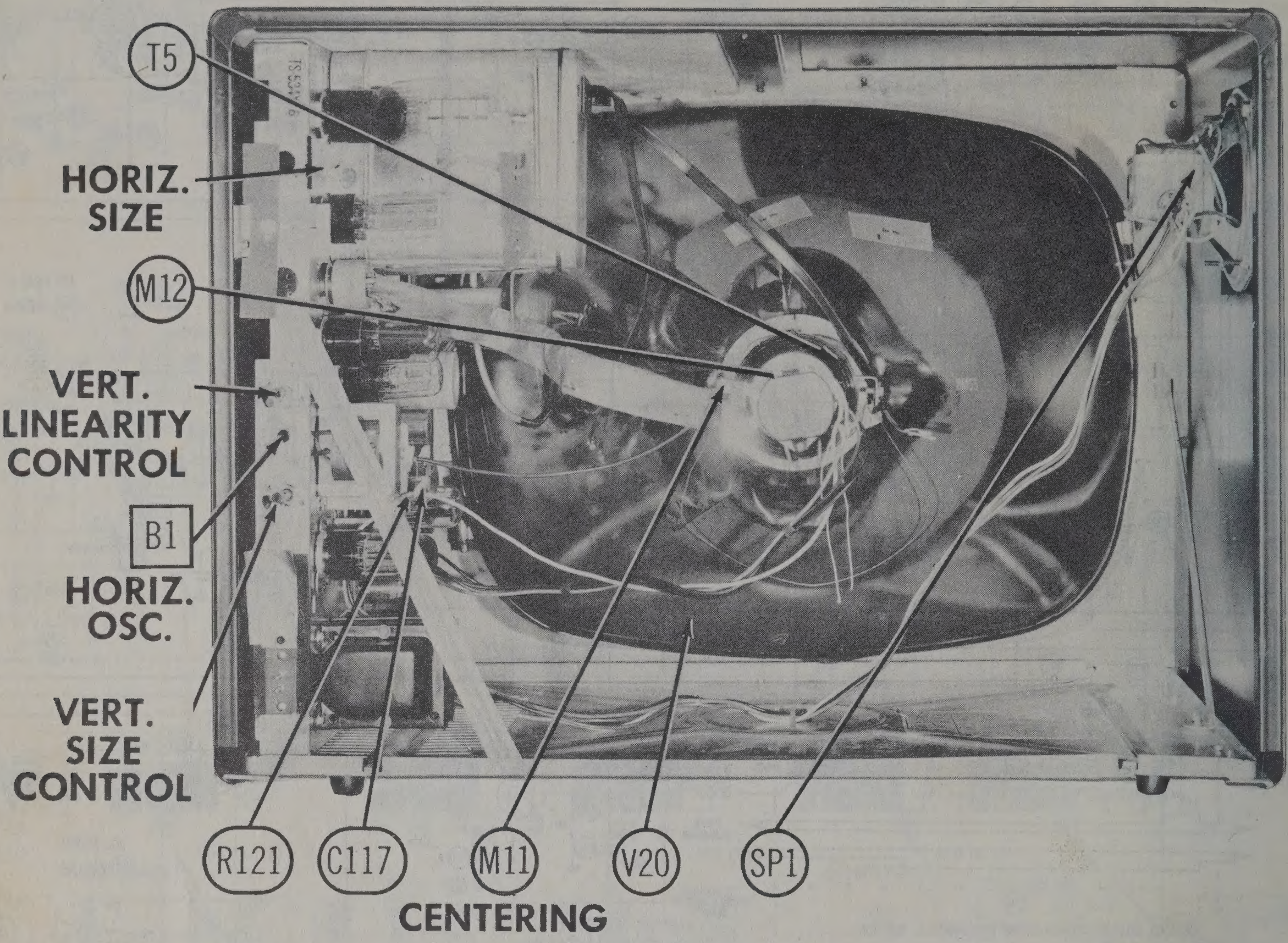
G256

DATE 4-56 SET 312 FOLDER 8



CABINET—REAR VIEW

HORIZONTAL SWEEP CIRCUIT ADJUSTMENTS

Turn the set on and tune in a TV station, preferably a test pattern. Adjust the brightness and contrast controls for a normal picture.

1. Short out the AFC voltage and shunt the horizontal oscillator coil (L46) to ground (chassis) with a .1MFD, 400V capacitor. This may be done with the chassis in cabinet by using the three pin sockets on rear of chassis labeled "Test Receptacle".

2. Adjust the horizontal hold control to the point where picture remains stable horizontally.

3. Remove .1MFD capacitor from L46 and adjust the horizontal oscillator slug (B1) to the point where picture remains stable horizontally.

4. Remove short from AFC voltage and adjust the horizontal hold control until picture remains in sync over approximately 30 degrees of its range while switching off channel and back again.

Adjust the horizontal size control (located just above the left rear side of the chassis) for a picture slightly wider than necessary to fill the picture mask horizontally.

PRODUCTION CHANGES

In later production the following models, chassis and production chages were made. Whenever possible the reason for the change is also made.

MODEL	CHASSIS	MODEL	CHASSIS
Y21K48B	TS-534Y	21K48M	TS-534
Y21K48M	TS-534Y		VTS-534
21K48B	TS-534		WTS-534

TV CHASSIS CODING SYSTEM

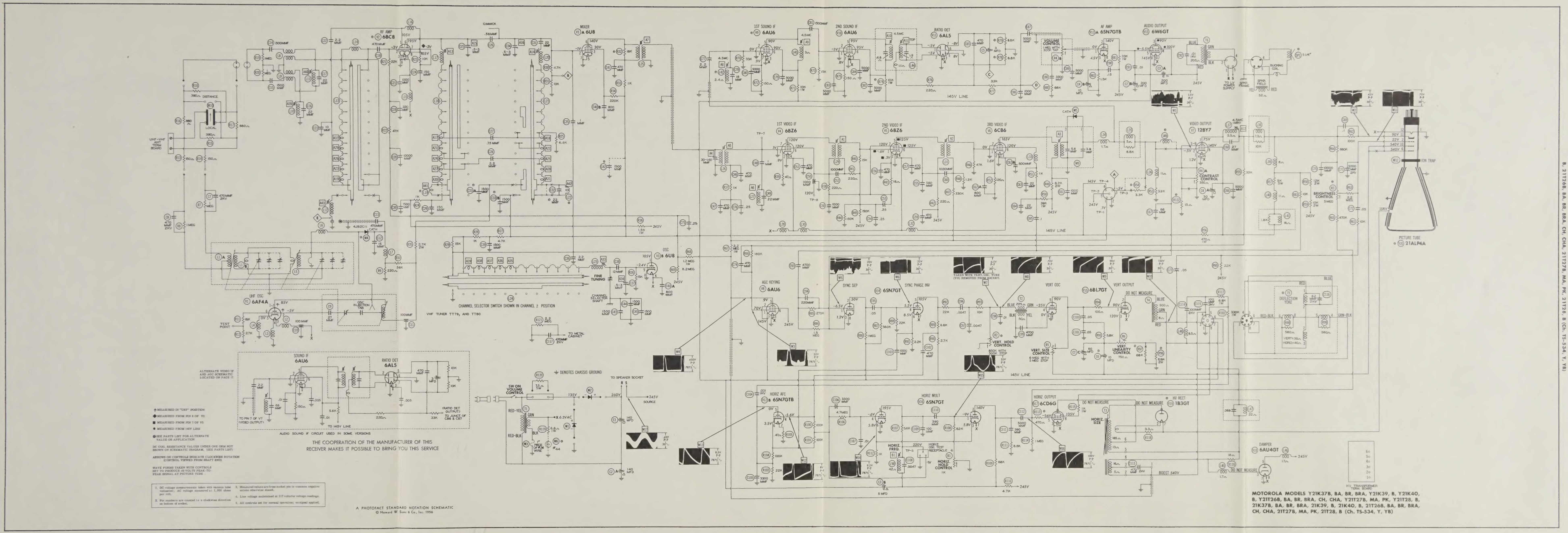
TS-534A-00	ORIGINAL chassis
A-01, 02, etc	MINOR ELECTRICAL REVISIONS of the "A" chassis.
A-01-0, A-02-1, etc.	DEVIATIONS from minor electrical revisions.
B-00	FIRST MAJOR REVISION of the original chassis.
B-01, -02, etc	MINOR ELECTRICAL CHANGES of the "B" chassis.
C-00	SECOND MAJOR REVISION of the original chassis.
C-01, -02, etc.	MINOR ELECTRICAL CHANGES of the "C" chassis.
D-00	THIRD MAJOR REVISION of the original chassis.
D-01, -02, etc.	MINOR ELECTRICAL CHANGES of the "D" chassis.

Prefixes such as VTS-534, WTS-543 are for mechanical changes.

A "Y" suffix added to the basic chassis (for example TS-534AY-00) indicates that the chassis contains a factory installed UHF tuner.

Ch. TS-534A-02	When R32 is increased from 15KΩ to 18KΩ the tuners are changed to part #TT-79B and TT-80B.
Ch. TS-534C-00	TO DECREASE HORIZONTAL PICK-UP The video IF circuit is revised. A partial schematic is given on page 17 showing the new arrangement. TO PREVENT A LINGERING SPOT ON THE PICTURE TUBE R60 is increased from 22KΩ to 68KΩ and removed from the 245 volt line and connected to ground. C73 is decreased from a .05MFD to a .01MFD. TO IMPROVE TONE QUALITY C91 is decreased from a .01MFD to a .0047MFD. TO ELIMINATE PARASITIC OSCILLATIONS A 100Ω resistor is added from pin 3 of V13 to the blue lead of the audio output transformer (T6).
Ch. TS-534C-01	TO IMPROVE CONTRAST An 18Ω resistor is added from the center arm of the contrast control (R4A) to ground. C117 is increased from 470MMF to a .01MFD.
Ch. TS-534C-02	TO CORRECT VERTICAL LINE STRUCTURE A shielded lead is added in place of the unshielded lead connecting between the horizontal hold control (R1) and R108.
Ch. TS-534C-03	COMPONENT CHANGE L48 is omitted and C114 is then connected directly to pin 6 of the deflection yoke (T5).
Ch. TS-534D-00	TO REDUCE ADJACENT CHANNEL INTERFERENCE A 47.25MC trap is added in the grid circuit of the first video IF stage. TO IMPROVE VIDEO IF ALIGNMENT An improved converter circuit is used. With this change the tuners change to part #TT-79C and TT-80C. A partial schematic is given on page 17 showing the new arrangement.
Ch. TS-534D-01	The part number of C1 is changed.
Ch. TS-534D-02	R115 is decreased from 1KΩ to 680Ω.

CONTINUED ON PAGE 12.


RF AMP
V2 6BC8
MIXER
V3 6U8
OSC
V3 6U8
UHF OSC
V1 6AF4A
UHF-VHF ANT TERM BOARD
DISTANCE
LOCAL
TEST POINT
VHF TUNER TT79, AND TT80
CHANNEL SELECTOR SWITCH SHOWN IN CHANNEL 2 POSITION
FINE TUNING
CHANNEL SELECTOR SHAFT
TO METAL CABINET
1ST SOUND IF
V9 6AU6
2ND SOUND IF
V10 6AU6
RATIO DET
V11 6AL5
AF AMP
V12 6SN7GTB
AUDIO OUTPUT
V13 6W6GT
VOLUME CONTROL
145V LINE
TO LV POWER SUPPLY
SPKR FIELD
BUCKING COIL
1ST VIDEO IF
V5 6BZ6
2ND VIDEO IF
V6 6BZ6
3RD VIDEO IF
V7 6CB6
VIDEO OUTPUT
V8 12BY7
CONTRAST CONTROL
BRIGHTNESS CONTROL
ION TRAP
PICTURE TUBE
V20 21ALP4A
AGC KEYING
V4 6AU6
SYNC SEP
V14 6SN7GT
SYNC PHASE INV
VERT OSC
V15 6BL7GT
VERT OUTPUT
VERT HOLD CONTROL
VERT SIZE CONTROL
VERT LINEARITY CONTROL
TAKEN WITH VERT. OSC. TUBE (V15) REMOVED FROM SOCKET.
DO NOT MEASURE
DEFLECTION YOKE
HORIZ AFC
V16 6SN7GTB
HORIZ MULT
V16 6SN7GT
HORIZ FREQ.
HORIZ OSC TEST RECEPTACLE
HORIZ HOLD CONTROL
HORIZ OUTPUT
V17 6CD6G
HV RECT
V19 1B3GT
HORIZ SIZE
BOOST 540V
DAMPER
V18 6AU4GT
HV TRANSFORMER TERM BOARD
SOUND IF
6AU6
RATIO DET
6AL5
TO PIN 7 OF V7 (VIDEO OUTPUT)
TO 145V LINE
(RATIO DET OUTPUT) TO JUNCT. OF C86 & C87
AUDIO SOUND IF CIRCUIT USED IN SOME VERSIONS
DENOTES CHASSIS GROUND
SW ON VOLUME CONTROL
TO SPEAKER SOCKET
245V SOURCE
RED-YEL
RED-BLK
6.3VAC

ALTERNATE VIDEO IF AND AGC SCHEMATIC LOCATED ON PAGE 17

- ✦ MEASURED IN "UHF" POSITION
- ◆ MEASURED FROM PIN 8 OF V2
- ■ MEASURED FROM PIN 7 OF V5
- ● MEASURED FROM 145V LINE
- ● SEE PARTS LIST FOR ALTERNATE VALUE OR APPLICATION

DC COIL RESISTANCE VALUES UNDER ONE OHM NOT SHOWN ON SCHEMATIC DIAGRAM. (SEE PARTS LIST)

ARROWS ON CONTROLS INDICATE CLOCKWISE ROTATION (CONTROL VIEWED FROM SHAFT END)

WAVE FORMS TAKEN WITH CONTROLS SET TO PRODUCE 45 VOLTS PEAK-TO-PEAK SIGNAL AT PICTURE TUBE

1. DC voltage measurements taken with vacuum tube voltmeter; AC voltage measured at 1,000 ohms per volt.
2. Pin numbers are counted in a clockwise direction on bottom of socket.
3. Measured values are from socket pin to common negative unless otherwise stated.
4. Line voltage maintained at 117 volts for voltage readings.
5. All controls set for normal operation; no signal applied.

THE COOPERATION OF THE MANUFACTURER OF THIS
RECEIVER MAKES IT POSSIBLE TO BRING YOU THIS SERVICE

A PHOTOFACT STANDARD NOTATION SCHEMATIC
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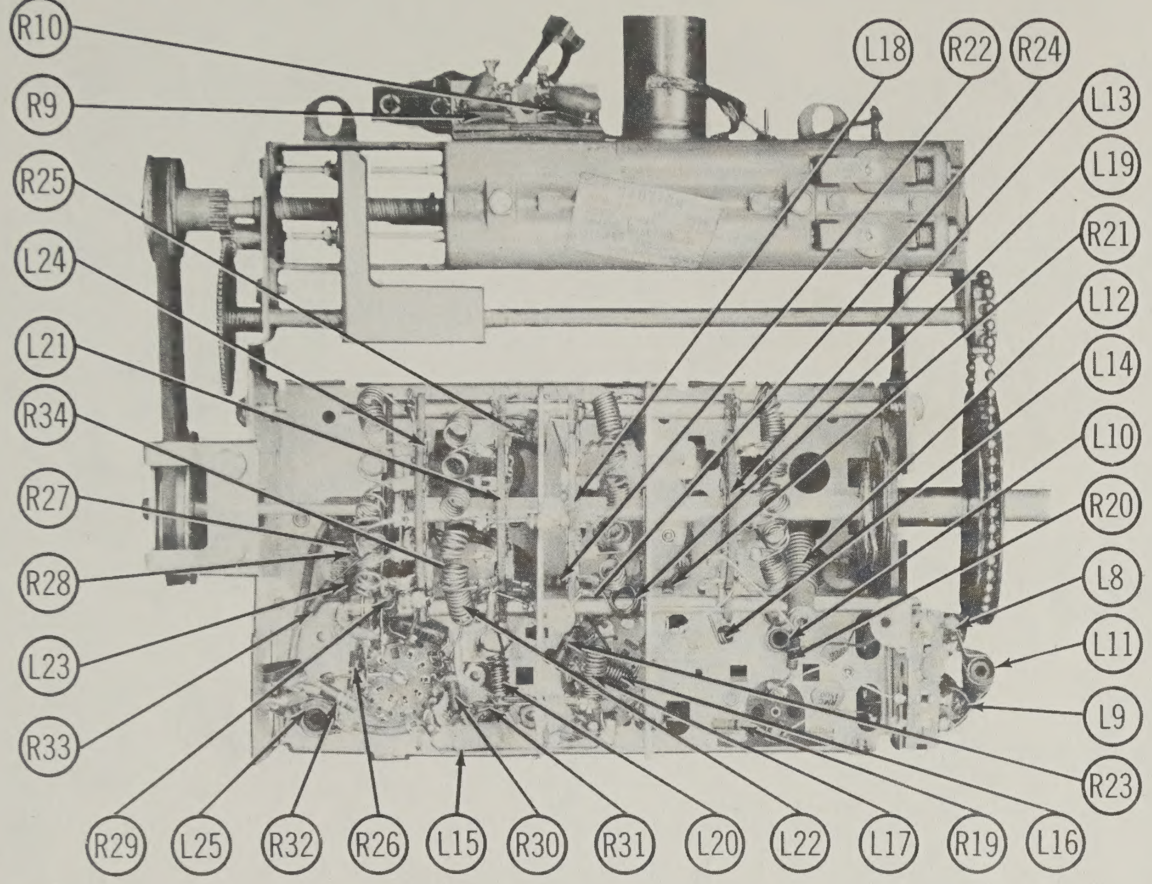
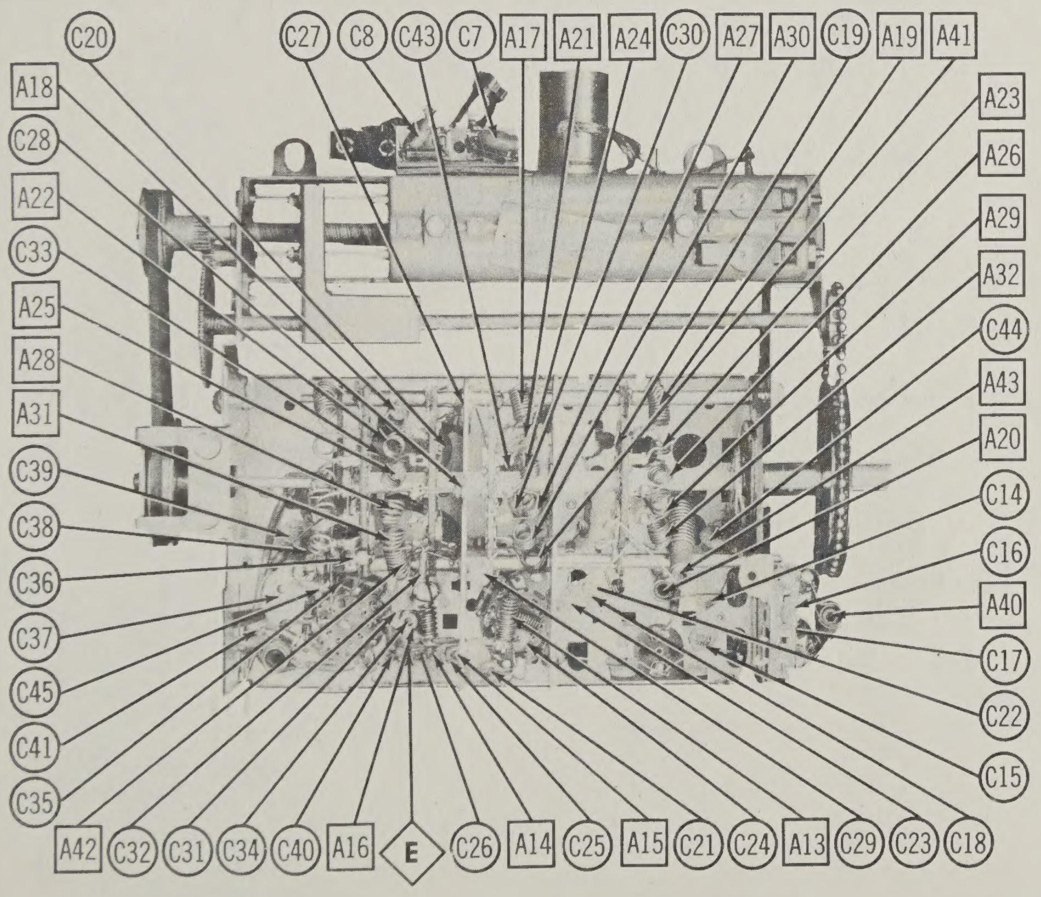
MOTOROLA MODELS Y21K37B, BA, BR, BRA, Y21K39, B, Y21K40, B, Y21T26B, BA, BR, BRA, CH, CHA, Y21T27B, MA, PK, Y21T28, B, 21K37B, BA, BR, BRA, 21K39, B, 21K40, B, 21T26B, BA, BR, BRA, CH, CHA, 21T27B, MA, PK, 21T28, B (Ch. TS-534, Y, YB)


R10
R9
R25
L24
L21
R34
R27
R28
L23
R33
L18
R22
R24
L13
L19
R21
L12
L14
L10
R20
L8
L11
L9
R23
R29
L25
R32
R26
L15
R30
R31
L20
L22
L17
R19
L16

VHF-UHF TUNER BOTTOM VIEW


C20
C27
C8
C43
C7
A17
A21
A24
C30
A27
A30
C19
A19
A41
A18
C28
A22
C33
A25
A28
A31
C39
C38
C36
C37
C45
C41
C35
A23
A26
A29
A32
C44
A43
A20
C14
C16
A40
C17
C22
C15
A42
C32
C31
C34
C40
A16
E
C26
A14
C25
A15
C21
C24
A13
C29
C23
C18

VHF-UHF TUNER BOTTOM VIEW

PRODUCTION CHANGES

In later production the following models, chassis and production chages were made. Whenever possible the reason for the change is also made.

MODEL	CHASSIS	MODEL	CHASSIS
Y21K48B	TS-534Y	21K48M	TS-534
Y21K48M	TS-534Y		VTS-534
21K48B	TS-534		WTS-534

TV CHASSIS CODING SYSTEM

TS-534A-00	ORIGINAL chassis
A-01, 02, etc	MINOR ELECTRICAL REVISIONS of the "A" chassis.
A-01-0, A-02-1, etc.	DEVIATIONS from minor electrical revisions.
B-00	FIRST MAJOR REVISION of the original chassis.
B-01, -02, etc	MINOR ELECTRICAL CHANGES of the "B" chassis.
C-00	SECOND MAJOR REVISION of the original chassis.
C-01, -02, etc.	MINOR ELECTRICAL CHANGES of the "C" chassis.
D-00	THIRD MAJOR REVISION of the original chassis.
D-01, -02, etc.	MINOR ELECTRICAL CHANGES of the "D" chassis.

Prefixes such as VTS-534, WTS-543 are for mechanical changes.

A "Y" suffix added to the basic chassis (for example TS-534AY-00) indicates that the chassis contains a factory installed UHF tuner.

Ch. TS-534A-02	When R32 is increased from 15KΩ to 18KΩ the tuners are changed to part #TT-79B and TT-80B.
Ch. TS-534C-00	TO DECREASE HORIZONTAL PICK-UP The video IF circuit is revised. A partial schematic is given on page 17 showing the new arrangement. TO PREVENT A LINGERING SPOT ON THE PICTURE TUBE R60 is increased from 22KΩ to 68KΩ and removed from the 245 volt line and connected to ground. C73 is decreased from a .05MFD to a .01MFD. TO IMPROVE TONE QUALITY C91 is decreased from a .01MFD to a .0047MFD. TO ELIMINATE PARASITIC OSCILLATIONS A 100Ω resistor is added from pin 3 of V13 to the blue lead of the audio output transformer (T6).
Ch. TS-534C-01	TO IMPROVE CONTRAST An 18Ω resistor is added from the center arm of the contrast control (R4A) to ground. C117 is increased from 470MMF to a .01MFD.
Ch. TS-534C-02	TO CORRECT VERTICAL LINE STRUCTURE A shielded lead is added in place of the unshielded lead connecting between the horizontal hold control (R1) and R108.
Ch. TS-534C-03	COMPONENT CHANGE L48 is omitted and C114 is then connected directly to pin 6 of the deflection yoke (T5).
Ch. TS-534D-00	TO REDUCE ADJACENT CHANNEL INTERFERENCE A 47.25MC trap is added in the grid circuit of the first video IF stage. TO IMPROVE VIDEO IF ALIGNMENT An improved converter circuit is used. With this change the tuners change to part #TT-79C and TT-80C. A partial schematic is given on page 17 showing the new arrangement.
Ch. TS-534D-01	The part number of C1 is changed.
Ch. TS-534D-02	R115 is decreased from 1KΩ to 680Ω.

CONTINUED ON PAGE 12.

PRODUCTION CHANGES (cont)

Ch. TS-534D-03	TO INCREASE AUDIO SENSITIVITY R70 is omitted. A shield is added under the ratio detector transformer (L44). The components are relocated and dressed close to the chassis.
Ch. TS-534D-04	TO PREVENT CAPACITOR BREAKDOWN The negative side of C6 is removed from the junction of C2C, R95 and R6 , and reconnected to the 245 volt line. ELECTROLYTIC ADDED A 20MFD, 500V electrolytic capacitor (part #23K710667) is added from the high side of the vertical linearity control (R6) to the 245 volt line.
Ch. TS-534D-05	TO REDUCE SLIPPAGE To reduce slippage, tension is applied to the drive belt by adding a roller and spring assembly. This change applies only to UHF models.
Ch. TS-534D-06, -0	TO IMPROVE CONTRAST The video amplifier circuit has been revised. A partial schematic is shown on page 17. COMPONENT CHANGE R115 is increased from 680Ω to 1KΩ.
Ch. TS-534D-07, -0	COMPONENT CHANGE The 470Ω resistor added across the contrast control (R4A) in change "D-06" is decreased to 220Ω. R115 is decreased from 1KΩ to 680Ω. In change "D-07-0", R115 is increased to 1KΩ.
Ch. TS-534D-08, -0	TO REDUCE FILAMENT VOLTAGE ON 1B3 R118 is increased from 3.3Ω to 4.7Ω. R115 is decreased to 680Ω. In change "D-08-0" R115 is increased to 1KΩ.
Ch. TS-534D-09, -0	TO IMPROVE SYNC The AGC circuit has been revised. A partial schematic is shown on page 17 showing the new arrangement. In change "D-09-0", R115 is increased to 1KΩ.

PARTS LIST AND DESCRIPTIONS

TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	REPLACEMENT DATA		NOTES
		MOTOROLA PART No.	STANDARD REPLACEMENT	
V1	UHF Oscillator	6AF4A	6AF4A	
V2	RF Amplifier	6BC8	6BC8	6BZ7 may be used as an alternate
V3	Mixer-Oscillator	6U8	6U8	
V4	1st. Video IF Amplifier	6BZ6	6BZ6	
V5	2nd. Video IF Amplifier	6BZ6	6BZ6	
V6	3rd. Video IF Amplifier	6CB6	6CB6	
V7	Video Output	12BY7	12BY7	
V8	AGC Keying	6AU6	6AU6	
V9	1st. Sound IF Amplifier	6AU6	6AU6	This stage not used in all versions
V10	2nd. Sound IF Amplifier	6AU6	6AU6	
V11	Ratio Detector	6AL5	6AL5	
V12	AF Amplifier-Horiz. AFC	6SN7GTB	6SN7GTB	
V13	Audio Output	6W6GT	6W6GT	
V14	Sync Separator-Sync Phase Inverter	6SN7GT	6SN7GT	
V15	Vert. Oscillator-Vert. Output	6BL7GT	6BL7GT	
V16	Horiz. Mult.	6SN7GT	6SN7GT	
V17	Horiz. Output	6CD6G	6CD6G	
V18	Damper	6AU4GT	6AU4GT	
V19	HV Rectifier	1B3GT	1B3GT	Do not use 1B3GT tube with internal connection between pins 3 and 7.

CATHODE-RAY TUBE

ITEM No.	REPLACEMENT DATA				NOTES
	MOTOROLA PART No.	CBS PART No.	GENERAL ELECTRIC PART No.	SYLVANIA PART No.	
V20	21ALP4A	21ALP4A ① 21ALP4 21ALP4B ① 24DP4A ①	21ALP4A ① 21ALP4	21ALP4A ② 21ALP4 21ALP4B ② 21ALP4A/B ②	① Aluminized ② Silver screen "85"

ELECTROLYTIC CAPACITORS

ITEM No.	RATING		REPLACEMENT DATA						
	CAP.	VOLT.	MOTOROLA PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	SPRAGUE PART No.
C1	■140	150	23B737620	AFHS1-70	XA004	FP117	TM-140-150	T-055	TVL-1428
C2A	▲140	150	23B731523		XB008	FP216.3	TM-3125	D-090	
B	■200	150			BR6045	TC68		MTD-4530	
C	▬60	200							
C3A	▬200	150	23B710941	AFHS2-109	B078	FP216.1	TM-2029	D-088	TVL-2444
B	▲5	150							
C4A	■30	150	23B736968	AFH3-06	C005	FP259	TM-2003	D-045	TVL-3435
B	▲10	50							
C5	3	50	23A690543	PRS150V4	BBR4-50	TC30	TD-4-50	MMT-0505	TVA-1303
C6	10	500	23K731537 (Note 1)	PRS500V10	BR1250	TC82	TD-10-500	S-315	TVA-1905

Note 1. Some versions use 20MFD in this application (part #23K737706).

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING		REPLACEMENT DATA							NOTES
	CAP.	VOLT	MOTOROLA PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	
C7	470	2000	21R115856	HVD-30-470	DD30-471	V2T47	3KV-471	DC30347	20GA-T47	
C8	470	2000	21R115856	HVD-30-470	DD30-471	V2T47	3KV-471	DC30347	20GA-T47	
C9	27		21A731037							
C10	100		21R120806							
C11	100		21R120806							
C12	15			SI15	DD-150	G021	831-150	UC-5415	5GA-Q15	
C13	470		21R114554	BPD-00047	DD-471	K060	831-471	UC-5347	5GA-T47	
C14	1500		21R120100	BPD-0015	DD-152	K071	801-0015	DC-5215	5HK-D15	
C15	1500		21R120100	BPD-0015	DD-152	K071	801-0015	DC-5215	5HK-D15	
C16	22		21R120539							
C17	22		21R120539							
C18	470		21R410121	BPD-00047	DD-471	K060	831-471	UC-5347	5GA-T47	
C19	220		21R410115	BPD-00022	DD-221	G051	811-221	UC-5322	5GA-T22	
C20	10000		21R482726	BPD-01	DD-103	K082	811-01	DC-511	5HK-S1	
C21	1000		21R115386	BPD-001	DD-102	K069	801-001	DC-521	5HK-D1	
C22	2.2		21R115948	NP0-SI2.2	TCZ-2R2	TZ05	NP0A-2R2		5TCCB-V22	
C23	10		21R121114	N750-DI10	TCN-10	N018	N750A-100	NT-541	5TCU-Q1	
C24	150		21R410112	BPD-00015	DD-151	G046	811-151	UC-5315	5GA-T15	
C25	.5-3		21K735985		829-3		3115-01-0R5	CT565A		
C26	.56		21A735622							
C27	.75		21K735623					ZT-5675		
C28	2.2		21R115948	NP0-SI2.2	TCZ-2R2	TZ05	NP0A-2R2		5TCCB-V22	
C29	150		21R410112	BPD-00015	DD-151	G046	811-151	UC-5315	5GA-T15	
C30	1500		21R120100	BPD-0015	DD-152	K071	801-0015	DC-5215	5HK-D15	
C31	22		21R120539							
C32	22		21R120539							Note 2
C33A	1500		21R120098	BPD-2X0015	DD2-152	DK071	812-0015	DCD-5215	5HK-2D15	Note 2
B	1500									Note 2
C34	.5-3		21K735985		829-3		3115-01-0R5	CT565A		
C35	1		21R114071							
C36	2.2		21R115948	NP0-SI2.2	TCZ-2R2	TZ05	NP0A-2R2		5TCCB-V22	
C37	.5-3		21K735985		829-3		3115-01-0R5	CT565A		
C38	12		21R121110							
C39	1500		21R120100	BPD-0015	DD-152	K071	801-0015	DC-5215	5HK-D15	
C40A	800		21R400943	BPD-2X001	DD2-102	DK069	812-001	DCD-521	5HK-2D1	
B	800									
C41	470		21R114554	BPD-00047	DD-471	K060	831-471	UC-5347	5GA-T47	
C42	1500		21R120100	BPD-0015	DD-152	K071	801-0015	DC-5215	5HK-D15	Note 3
C43	1500		21R120100	BPD-0015	DD-152	K071	801-0015	DC-5215	5HK-D15	
C44	1500		21R120100	BPD-0015	DD-152	K071	801-0015	DC-5215	5HK-D15	
C45	1500		21R120100	BPD-0015	DD-152	K071	801-0015	DC-5215	5HK-D15	
C46	470		21R114554	BPD-00047	DD-471	K060	831-471	UC-5347	5GA-T47	
C47	470		21R114554	BPD-00047	DD-471	K060	831-471	UC-5347	5GA-T47	
C48	1		21R115956	NP0-SI1	TCZ-1	TZ03	NP0A-010		5TCCB-V1	

CAPACITORS (cont)

ITEM No.	RATING		REPLACEMENT DATA							NOTES
	CAP.	VOLT	MOTOROLA PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	
C49	22		21R120539							
C50	1000		21R122549	EF-001	MFT-1000				503C-D1	
C51	470		21R114554	BPD-00047	DD-471	K060	831-471	UC-5347	5GA-T47	
C52	1000		21R115386	BPD-001	DD-102	K069	801-001	DC-521	5HK-D1	
C53	.25	100	8K122045	P288N-25		CUB2P25		PT4025	2TM-P25	
C54	.25	200	8K121575	P288N-25		CUB2P25		PT4025	2TM-P25	
C55	560		21R120936	SI560	DD-561	G063	811-561	UC-5356	5GA-T56	
C56	470		21R410121	BPD-00047	DD-471	K060	831-471	UC-5347	5GA-T47	
C57	470		21R114554	BPD-00047	DD-471	K060	831-471	UC-5347	5GA-T47	
C58	1000		21R115386	BPD-001	DD-102	K069	801-001	DC-521	5HK-D1	
C59	470		21R114554	BPD-00047	DD-471	K060	831-471	UC-5347	5GA-T47	
C60	1000		21R115386	BPD-001	DD-102	K069	801-001	DC-521	5HK-D1	
C61	1000		21R115386	BPD-001	DD-102	K069	801-001	DC-521	5HK-D1	
C62A	800		21R400943	BPD-2X001	DD2-102	DK069	812-001	DCD-521	5HK-2D1	
B	800									
C63	22		21R120539							
C64	22		21R120539							
C65	.1	200	8R121573	P288N-1	DF-104	CUB2P1		PT401	2TM-P1	
C66	5000		21R115312	BPD-005	DD-502	K080	811-005	DC-525	5HK-D5	
C67	68		21R400930							
C68	27		21R119896							
C69	.1	200	8R121573	P288N-1	DF-104	CUB2P1		PT401	2TM-P1	
C70	10000		21R482726	BPD-01	DD-103	K082	811-01	DC-511	5HK-S1	
C71	5000	2000	21R120093	HVD-30-4700		V2D5			20HK-D5	
C72	.05	400	8R121567	BPD-05	DF-503	CUB4S5		PT415	4TM-S5	
C73	.05	400	8R121567	BPD-05	DF-503	CUB4S5		PT415	4TM-S5	
C74	470		21R121797	BPD-00047	DD-471	K060	831-471	UC-5347	5GA-T47	
C75	.25	200	8K121575	P288N-25		CUB2P25		PT4025	2TM-P25	
C76	.25	200	8K121575	P288N- 25		CUB2P25		PT4025	2TM-P25	
C77	2.2		21R115948	NP0-SI2.2	TCZ-2R2	TZ05	NP0A-2R2		5TCCB-V22	
C78	18		21R120578							
C79	5000		21R115312	BPD-005	DD-502	K080	811-005	DC-525	5HK-D5	
C80	5000		21R115312	BPD-005	DD-502	K080	811-005	DC-525	5HK-D5	
C81	1500		21R120100	BPD-0015	DD-152	K071	801-0015	DC-5215	5HK-D15	
C82	5000		21R115312	BPD-005	DD-502	K080	811-005	DC-525	5HK-D5	
C83	5000		21R115312	BPD-005	DD-502	K080	811-005	DC-525	5HK-D5	
C84	5000		21R115312	BPD-005	DD-502	K080	811-005	DC-525	5HK-D5	
C85	470		21R121797	BPD-00047	DD-471	K060	831-471	UC-5347	5GA-T47	
C86	1000		21R410127	BPD-001	DD-102	K069	801-001	DC-521	5HK-D1	
C87	5000		21R115312	BPD-005	DD-502	K080	811-005	DC-525	5HK-D5	
C88	3300		21R120422	BPD-0033	D6-332	K077	811-0033	UC-5233	5HK-D33	
C89	5000		21R115312	BPD-005	DD-502	K080	811-005	DC-525	5HK-D5	
C90	.15	400	8R122174	P488N-15		CUB4P15		PT4015	4TM-P15	
C91	.01	400	8K734633	BPD-01	D6-103	CUB4S1	GP3-333-103	PT415	4TM-S1	
C92	.01	1000	8R121790	P1088N-01	DD-103	CUB16S1		PT1611	MB-S1	
C93	4700		21R120149	BPD-0047	DD-472	K079	811-0047	DC-525	5HK-D47	
C94	220		21K122420	BPD-00022	DD-221	G051	811-221	UC-5322	5GA-T47	
C95	.05	400	8R121567	BPD-05	DF-503	CUB4S5		PT415	4TM-S5	
C96	.0047	400	8K734634	BPD-0047	D6-472	CUB6D47	GP2-333-472	PT6247	6TM-D47	
C97	.0047	400	8K734634	BPD-0047	D6-472	CUB6D47	GP2-333-472	PT6247	6TM-D47	
C98	.01	400	8K734633	BPD-01	D6-103	CUB4S1	GP3-333-103	PT411	4TM-S1	
C99	4700		21R120149	BPD-0047	DD-472	K079	811-0047	DC-525	5HK-D47	
C100	.05	400	8R121567	BPD-05	DF-503	CUB4S5		PT415	4TM-S5	
C101	.05	400	8R121567	BPD-05	DF-503	CUB4S5		PT415	4TM-S5	
C102	470		21R410121	BPD-00047	DD-471	K060	831-471	UC-5347	5GA-T47	
C103	10000		21R410127	BPD-001	DD-102	K069	801-001	DC-521	5HK-D1	
C104	.001	1000	8R122104	HVD-15-1000	DD-102	CUB16D1	1R5KV-102	DC3021	MB-D1	
C105	3300		21R120422	SI3300	D6-332	K077	811-0033	UC-5233	5HK-D33	
C106	3300		21R120422	SI3300	D6-332	K077	811-0033	UC-5233	5HK-D33	
C107	.01	400	21R121946	BPD-01	D6-103	CUB4S1	GP3-333-103	PT411	4TM-S1	
C108	.0047	400	8K734634	1464-0047		1R5D47		MCB465	MS-247	
C109	100		21R400537	1469-0001	DD-101	5R5T1	811-101	MCB235	MS-31	
C110	390		21B735757	1469-00039	D6-391	5R5T39	811-391	MCB243	MS-339	
C111	390		21B735757	1469-00039	D6-391	5R5T39	811-391	MCB243	MS-339	
C112	5000		21R115312	BPD-005	DD-502	K080	811-005	DC-525	5HK-D5	
C113	470	2000	21R121478	HVD-30-470	DD30-471	V2T47	3KV-471	DC30347	20GA-T47	
C114	100	2000	21R122526	HVD-30-100	DD30-101	V2T1	3KV-101	DC3031	20GA-T1	
C115	100	2000	21R122526	HVD-30-100	DD30-101	V2T1	3KV-101	DC3031	20GA-T1	
C116	82	2000	21R120150		DD30-820				20GA-Q82	
C117	470	2000	21R121478	HVD-30-470	DD30-471	V2T47	3KV-471	DC30347	20GA-T47	

Note 2. Not used in tuner TT-79
Note 3. Not used in tuner TT-80.

CONTROLS

ITEM No.	RATING		REPLACEMENT DATA					INSTALLATION NOTES
	RESISTANCE	WATTS	MOTOROLA PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	MALLORY PART No.	
R1A	100KΩ	½	18K735220	AB-40	A47-100K-S	Q11-128	TAP15L	Horiz. Hold-See Note 1
B	Shaft		Not Req.	AK-19	RN-3	TQ	Not Req.	Attach to R1A.
R2A	850KΩ	½	18K733417	AB-59 ♦	A47-500K-S♦	Q11-133 ♦	TAP55L ♦	Vert. Hold-Note 2-Stop at 500KΩ
B	Shaft		Not Req.	AK-19	RN-3	TQ	Not Req.	Attach to R2A.
R3A	5Meg	½	18K733415	AB-87	A47-5Meg-S	Q11-141	TAP56L	Brightness-Note 3
B	Shaft		Not Req.	AK-19	RN-3	TQ	Not Req.	Attach to R3A.
R4A	350Ω	½	18B736125	F1-0	RTV-549	QJ-872 ‡	UF52L	Contrast (Panel)
B	1Meg	½		R2-62			UR16- T35	Volume Tap at 300KΩ (Rear)
C	Switch			KB-1			US-26	Attach to R4B.
R5A	6Meg	½	18B733413	AB-87 †	A47-5Meg-S †	Q11-141 †	SU-67 †	Vert. Size-Stop at 5Meg
B	Shaft		Not Req.	AK-19	RN-3	TQ	Not Req.	Attach to R5A.
R6A	750Ω	½	18K733414	AB-5	A47-750-S	Q11-105	TAP751L	Vertical Linearity
B	Shaft		Not Req.	AK-19	RN-3	TQ	Not Req.	Attach to R6A.

Note 1. Part No. 18K737347 used in some versions.
Note 2. Part No. 18K737346 used in some versions,
♦ Connect a 330KΩ resistor in series with the right hand terminal of the control, and the lead connecting to the same terminal of the original control (control viewed from shaft end, terminals down).
Note 3. Part No. 18K737345 used in some versions.
† Connect a 1Meg resistor in series with the right hand terminal of the control, and the lead connecting to the same terminal of the original control (control viewed from shaft end, terminals down).
‡ Concentrikit Equivalent, K-2 Kit, Base Elements and Shafts, B11-103, P10-110 (Panel)
B13-137X, R21-201 (Rear)
76-1 (Switch)

PARTS LIST AND D

RES

ITEM No.	RATING		REPLACEMENT DATA		NOT
	OHMS	WATT	MOTOROLA PART No.	IRC PART No.	
R7	1Meg	½		BTS-1Meg	
R8	1Meg	½		BTS-1Meg	
R9	220Ω	½		BTS-220Ω	
R10	56KΩ	½		BTS -56KΩ	
R11	18KΩ	½			
R12	2700Ω	½		BTS-2700	
R13	150Ω	½		BTS-150	
R14	150Ω	½		BTS-150	
R15	390Ω	½	6R5554	BTS-390	
R16	680Ω	½	6R6040	BTS-680	
R17	680Ω	½	6R6040	BTS-680	
R18	390Ω	½	6R5554	BTS-390	
R19	1Meg	½	6R6004	BTS-1Meg	
R20	1Meg	½	6R6004	BTS-1Meg	
R21	22KΩ	½	6R6028	BTS-22K	
R22	47KΩ	½	6R6056	BTS-47K	
R23	10KΩ	½	6R6054		
R24	1000Ω	½	6R6301	BTS-1000	
R25	6800Ω	½	6R490839	BTS-6800	
R26	15KΩ	½	6R2119		
R27	4700Ω	½	6R6039	BTS-4700	
R28	1000Ω	½	6R6301	BTS-1000	
R29	15KΩ	½	6R2119		
R30	4700Ω	½	6R6039	BTS-4700	
R31	10KΩ	½	6R6054	BTS-10K	
R32	18KΩ	½	6R5591		Note
R33	1000Ω	½	6R6301	BTS-1000	
R34	220KΩ	½	6R6015	BTS-220K	
R35	2700Ω	2		BTB-2700	
R36	1500Ω	1	6R5700	BTA-1500	
R37	1000Ω	½	6R6301	BTS-1000	
R38	220Ω	½	6R3933	BTS-220	
R39	47Ω	½	6R5550	BTS-47	
R40	15KΩ	½	6R6477		
R41	220Ω	½	6R3933	BTS-220	
R42	220Ω	½	6R3933	BTS-220	
R43	18Ω	½	6R2031	BTS-18	
R44	150KΩ	½	6R6398	BTS-150K	
R45	150KΩ	½	6R6398	BTS-150K	
R46	47KΩ	½	6R6048	BTS-47K	
R47	330KΩ	½	6R2096		
R48	1200Ω	½	6R6393	BTS-1200	
R49	8200Ω	2	6K120579		
R50	39KΩ	1	6R5588	BTA-39K	
R51	1000Ω	½	6R6301	BTS-1000	
R52	120Ω	½	6R5551	BTS-120	
R53	3900Ω	½	6R5659	BTS-3900	
R54	3300Ω	½	6R6036	BTS-3300	Note
R55	33KΩ	½	6R6410	BTS-33K	
R56	470Ω	1	6R5593	BTA-470	
R57	5000Ω	5	17K734189	PW7-5000	
R58	12KΩ	2	6K121488	BTB-12K	
R59	10KΩ	2	6R6299	BTB-10K	
R60	22KΩ	½	6R6397	BTB-22K	
R61	10KΩ	½	6R6054	BTS-10K	
R62	100KΩ	½	6R6031	BTS-100K	
R63	2. 2Meg	½	6R3927	BTS-2. 2Meg	
R64	680KΩ	½	6R6475	BTS-680K	

Note 1. Some versions use a 15KΩ ½W r
Note 2. Some versions use a 5600Ω 1W
Note 3. Some versions use a 10KΩ ½W r
Note 4. Use heat dissipating band. If b
Note 5. Not used in some versions.

TRANSFOR

ITEM No.	RATING				MOTORO PART N
	PRI.	SEC. 1	SEC. 2	SEC. 3	
T1	117VAC @.82A	6.3VAC @12.4A			25B736967

① Drill new mounting holes.
② Parallel all Secondary windings.

TRANSFORMERS

ITEM No.	USE	MOTOROLA PART No.	Halldorson PART No.	PAR
T2	Vert. Osc. Trans.	25K736254	B6704	A-3
T3	Horiz. Output Trans.	24K736488 ①		
T4	Vert. Output Trans.	25K736255	Z1804	A-3
T5A	Yoke(90°)Horiz.(24MH)	24D736978 ②	DF607	MD
B	Vert. (40MH)	24D736445 ③	④⑤⑥⑦	④

① Includes primary winding Motorola Part No. 24K737217
Part No. 46K735112.
② Does not include yoke retainer wedge Motorola Part No
③ Alternate deflection yoke.
④ Use original centering device & deflection yoke cover M
⑤ Use original core clamp.
⑥ Jumper yoke terminals #3 & #6.
⑦ Use original horizontal damping network.

TRANSFORMER

ITEM No.	IMPEDANCE		REPLACEMENT		
	PRI.	SEC.	MOTOROLA PART No.	Halldorson PART No.	Merit PART No.
T6	2.7KΩ	3.6Ω	25K736256	Z1001 ①	A3018

RIPTIONS (Continued)

RS

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	MOTOROLA PART No.	IRC PART No.	
R65	470KΩ	½	6R6377	BTS-470K	
R66	180K 5%	½	6R6444	BTS-180K 5%	
R67	2. 2Meg	1	6R2011	BTA-2. 2Meg	
R68	1. 2Meg 5%	1	6R122602	BTA-1. 2Meg 5%	
R69	8. 2Meg 5%	½	6R114114	BTS-8. 2Meg 5%	
R70	33KΩ	½	6R6410	BTS-33K	
R71	10KΩ	1	6R6430	BTA-10K	
R72	150Ω	½	6R6373	BTS-150	
R73	15KΩ	½	6R6477	BTS-15K	
R74	10KΩ	1	6R5654	BTA-10K	Note 2
R75	150Ω	½	6R6373	BTS-150	
R76	220Ω	½	6R6270	BTS-220	
R77	33KΩ	½	6R6410	BTS-33K	
R78	6800Ω	½	6R6428	BTS-6800	Note 3
R79	6800Ω	½	6R6428	BTS-6800	Note 3
R80	68KΩ	½	6R6001	BTS-68K	
R81	33KΩ 5%	1	6R5758	BTA-33K 5%	
R82	1500Ω 5%	½	6R400459	BTS-1500 5%	
R83	10KΩ	½	6R6320	BTS-10K	
R84	1. 5Meg	½	6R3966	BTS-1. 5Meg	
R85	270KΩ	½	6R6414	BTS-270K	
R86	1Meg	½	6R6046	BTS-1Meg	
R87	560KΩ	½	6R5697	BTS-560K	
R88	22KΩ	½	6R6397	BTS-22K	
R89	6800Ω	½	6R6428	BTS-6800	
R90	2700Ω	½	6R5577	BTS-2700	
R91	2200Ω	½	6R6069	BTS-2200	
R92	22KΩ	½	6R6028	BTS-22K	
R93	10KΩ	½	6R6054	BTS-10K	
R94	100Ω	½	6R6018	BTS-100	
R95	5600Ω	½	6R6117	BTS-5600	
R96	6800Ω	2	6K122012	BTB-6800	Note 4
R97	68KΩ	½	6R6074	BTS-68K	Note 5
R98	560Ω	½	6R6291		
R99	560Ω	½	6R6291		
R100	100KΩ	½	6R6031		
R101	100KΩ	½	6R6031		
R102	330KΩ	1	6K122578		
R103	22KΩ	½	6R6397		
R104	100KΩ	½	6R6031		
R105	. 47Ω	½	17K488266	BW½-. 47	
R106	4. 7Meg 5%	½	6R2122		
R107	5600Ω	½	6R6117	BTS-5600	
R108	82KΩ	½	6R5644	BTS-82K	
R109	68KΩ	½	6R6074	BTS-68K	
R110	4700Ω	½	6R6080		
R111	6800Ω	½	6R6428		
R112	1000Ω	½	6R6229	BTS-1000	
R113	470Ω	½	6R3949		Note 5
R114	1Meg	½	6R6046		
R115	1000Ω	1	6R6327		
R116	18Ω	½	6R2031		
R117	6800Ω	1	6R490492	BTA-6800	
R118	3. 3Ω	½	17K485412	BW½-3. 3	
R119	6. 8Ω	1	6K120580		
R120	7. 5Ω	5	17A711500		
R121	2. 2Meg	½	6R3927	BTS-2. 2Meg	
R122	15Ω	½	6R2034	BTS-15	Note 5

in this application. (Mfgr. Part No. 6R6477)
in this application. (Mfgr. Part No. 6R5654)
in this application. (Mfgr. Part No. 6R6320)
ot used the wattage rating must be doubled.

(FILAMENT)

REPLACEMENT DATA				
Halldorson PART No.	Merit PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
		P6309 ①	21F24 ②	F-22A ①

EEP CIRCUITS)

REPLACEMENT DATA				
RCA TYPE No.	Ram PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
222T1 235D1 ④⑤⑥⑦	V313 Y90F19/43 ④⑤⑥⑦	A-8123 DY-16A ④⑤⑥⑦	26S52 Y-16 ④⑤⑥⑦	A-102X Y-41-1 ④⑤⑥⑦

dary winding Motorola Part No. 24K737218, and core Motorola

6257, nor yoke wedge clamp Motorola Part No. 42A736175.

Part No. 48A721145.

DIO OUTPUT)

or No.	Thordarson PART No.	Triad PART No.	NOTES
9	26S50	S-5Z	① Drill one new mounting hole.

SPEAKER

ITEM No.	RATINGS			REPLACEMENT DATA			NOTES
	SIZE	FIELD	V. C. IMP.	MOTOROLA PART No.	QUAM PART No.	RCA TYPE No.	
SP1	5 1/4" 5 1/4" 6" 8" 8" 8" 7"	50Ω 50Ω 50Ω 50Ω 50Ω 50Ω 50Ω	3.6Ω 3.6Ω 3.6Ω 3.6Ω 3.6Ω 3.6Ω 3.6Ω	50K737292 ① 50K737293 ② 50K737736 ③ 50C737448 ⑤ 50C733233 ⑥ 50K737006 ⑦ 50C737672 ④	52E50S 52E50S 6E50S 8E50S 8E50S 8E50S		① Used in Models 21T26B, BA, BR, BRA, CH, CHA, Y21T26B, BA, BR, BRA, CH, CHA, 21T27B, MA, PK, Y21T27B, MA, PK ② Used in Models 21T28, B, Y21T28, B ③ Used in Models 24T3BR, Y24T3BR ④ Used in Models 21K37B, BA, BR, BRA, Y21K37B, BA, BR, BRA ⑤ Used in Models 21K39, B, Y21K39, B ⑥ Used in Models 21K40, B, Y21K40, B ⑦ Used in Models 24K9, B, Y24K9, B

COILS (RF-IF)

ITEM No.	USE	DC RES.		REPLACEMENT DATA				NOTES
		PRI.	SEC.	MOTOROLA PART No.	MEISSNER PART No.	MERIT PART No.	MILLER PART No.	
L1A	UHF Ant. Coupling	0ΩCT		1V730900				Includes R7, R8, C7, C8
B	UHF RF Coupling Loop	0Ω		84B730674				
L2	Fil. Choke	0Ω		24K712254				
L3	Fil. Choke	0Ω		24K712254				
L4	Cathode Choke	0Ω		24K721430				
L5	UHF Osc. Coil	0Ω		24B730126				Less tuning core assembly
L6	UHF Osc. Coupling Coil	0Ω						Tuning core assembly part #1B730885
L7	RF Coil	0Ω						
L8	VHF Ant. Match. Trans.	.7Ω	.7Ω	24K730677				
L9	VHF Ant. Match. Trans.	.7Ω	.7Ω	24K730677				
L10	FM Trap	0Ω		24A736469				
L11	IF Trap	0Ω		24A734306				
L12	UHF IF Input Coil	0Ω		24K736960				Note 1
L13	VHF Ant.Coils	0Ω		24K734968				
L14	VHF Ant. Coil	0Ω		24A734859				Channel 13
L15	Fil. Choke	0Ω		24K730391				
L16	Neut. Coil	0Ω		24B721256				
L17	VHF RF Coil	0Ω		24A734731				Channel 13
L18	VHF RF Coils	0Ω		24C734967				
L19	UHF IF Coil	0Ω		24A734858				Note 1
L20	VHF Mixer Coil	0Ω		24A734732				Channel 13
L21	VHF Mixer Coils	0Ω		24K734969				Part #24K736462 used in tuner #TT-79
L22	UHF IF Coil	0Ω		24K734969				Note 1
L23	VHF Osc. Coil	0Ω		24A736468				Channel 13
L24	VHF Osc.Coils	0Ω		24K730839				
L25	Conv. Plate	.2Ω	.1Ω	24B736269				
L26	1st. Video IF	0Ω	.1Ω	24K736270	17-4522	TV-130	6219	
L27	41.25MC Trap	0Ω		24B736966		TV-131	6225	
L28	Fil. Choke	0Ω		24K730391	19-1001	TV-189	4604	1.3 Microhenries
L29	2nd. Video IF	.2Ω	.2Ω	24B736267	17-4522	TV-130	6219	
L30	Fil. Choke	0Ω		24K730391	19-1001	TV-189	4604	1.3 Microhenries
L31	3rd. Video IF	.2Ω	.2Ω	24B736268	17-4523	TV-130	6219	
L32	Fil. Choke	0Ω		24K730391	19-1001	TV-189	4604	1.3 Microhenries
L33	RF Coil	0Ω		24A732652	19-1002		4606	2 Microhenries
L34	Series Peaking Coil	1.7Ω		24R119889	19-1005		4612	10 Microhenries
L35	Series Peaking Coil	5Ω		24K736961	19-3125 *		6153 *	115 Microhenries, wound on 6.8KΩ resistor
L36	Shunt Peaking Coil	11Ω		24K736963	19-4400		6136	440 Microhenries
L37	4.5MC Trap	5.5Ω		24K737615	20-1004	TV-151	1469	
L38	Series Peaking Coil	7.3Ω		24K736012	19-3250 ■	TV-185	6181 ■	246 Microhenries, wound on 10KΩ resistor
L39	Shunt Peaking Coil	6Ω		24C736006	19-3180	TV-184	6180	175 Microhenries
L40	Shunt Peaking Coil	11Ω		24K736963	19-4400		6136	440 Microhenries
L41	Shunt Peaking Coil	16Ω		24K736496	19-4950 ▲		6157▲	945 Microhenries wound on 1.8KΩ resistor
L42	1st. Sound IF	2.4Ω		24K737342	20-1004	TV-151	1469	Alternate part #24B736734
L43	2nd. Sound IF	3Ω		24B733873	20-1005 ♦	TV-151 ♦	1470	
L44	Ratio Det.	4.6Ω	1.9ΩCT	24B736673	17-3497	TV-115	6205	Tertiary winding -1.1Ω
L45	RF Choke	1.7Ω		24A733225	19-1005		4612	10 Microhenries
L46	RF Choke	1.7Ω		24A733225	19-1005		4612	10 Microhenries
L47	Linearity Coil	22Ω		24A731609				Wound on .068 MFD Cap.
L48	RF Coil	8.5Ω		24B735522	19-3300		6132	336 Microhenries
L49	Series Peaking Coil			24R121728	19-1005 †		4612 †	13 Microhenries

Note 1. Used only in tuner #TT-80.
* Parallel with 6.8KΩ resistor.
■ Parallel with 10KΩ resistor.
▲ Parallel with 1.8KΩ resistor.
♦ Remove capacitor across coil.
† Parallel with 8.2KΩ resistor.

TRANSFORMER (HORIZ. OSC.)

ITEM No.	DC RES.		REPLACEMENT DATA							NOTES
	PRI.	SEC.	MOTOROLA PART No.	MEISSNER PART No.	MERIT PART No.	MILLER PART No.	RCA TYPE No.	Ram PART No.	Thordarson PART No.	
L50	42Ω		1V736152							

PARTS LIST AND DESCRIPTIONS (Continued)

SELENIUM RECTIFIER

ITEM No.	RATING	REPLACEMENT DATA						NOTES
	CURRENT	MOTOROLA PART No.	FEDERAL PART No.	INTERNATIONAL PART No.	MALLORY PART No.	RADIO RECEPTOR PART No.	SARKES TARZIAN PART No.	
M1	.255ADC	48K122479	1238A	RS350	6S350	6Q4	350X	
M2	.255ADC	48K122479	1238A	RS350	6S350	6Q4	350X	

FUSES

ITEM No.	TYPE	RATING	REPLACEMENT DATA					
			MOTOROLA PART No.		LITTELFUSE PART No.		BUSS PART No.	
			FUSE	HOLDER	FUSE	HOLDER	FUSE	HOLDER
M3	1" piece of #26 wire							

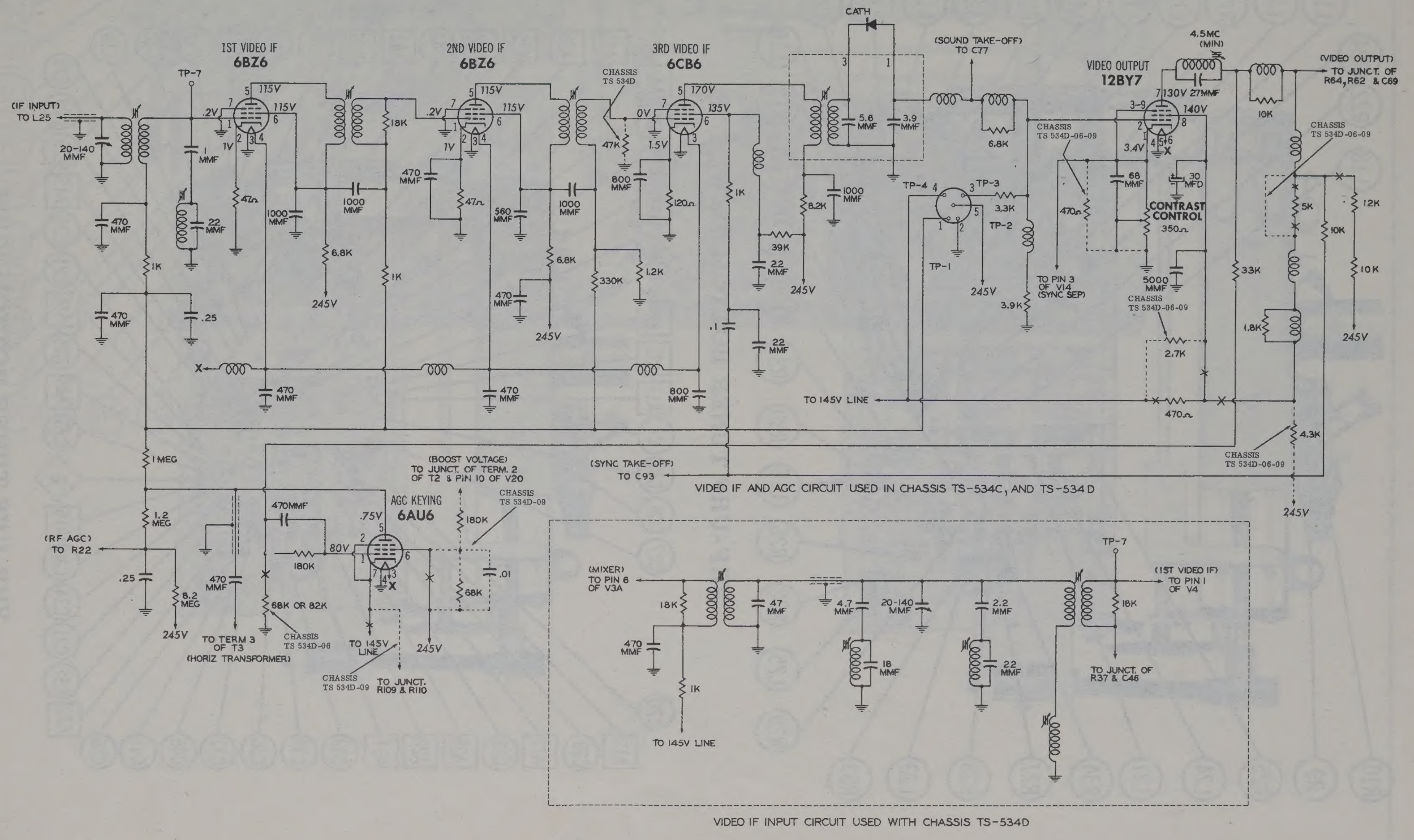
CRYSTAL DIODES

ITEM No.	ORIG. TYPE	REPLACEMENT DATA		NOTES
		MOTOROLA PART No.	SYLVANIA PART No.	
M4	4JB2C11	48K731312 *	1N82 or 1N82A	UHF Mixer (Clip-in)
M5		48K733204 †	1N60	Video Det. (Pigtail)

* Alternate part #48K731313, 48K731314.
† Alternate part #48K722720.

MISCELLANEOUS

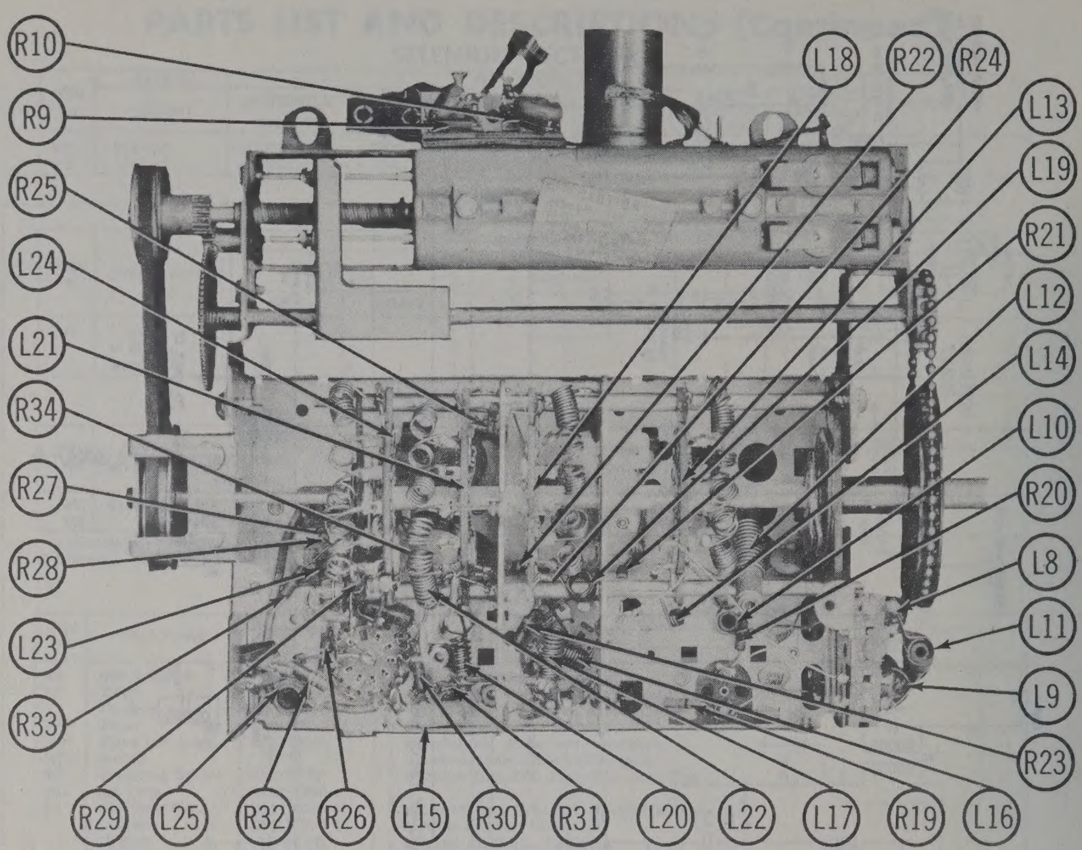
ITEM No.	PART NAME	MOTOROLA PART No.	NOTES
M6	Dial Light	65X10867	#44 - Not used in some versions.
M7	Tuner	1U736211	VHF- TT-80 - Used in Ch. TS-534Y.
	Tuner	1U736206	VHF - TT-79, used in Ch. TS-534 .
M8	Tuner	RTT-37	UHF - Used in Ch. TS-534Y.
M9	Video Det. Assy.	24K737340	Includes M5, coils, and capacitors
M10	Switch		Local-distance (DPDT-Slide type)
M11	Centering Device	48A721145	Includes deflection yoke (T5) rear cover
M12	Ion Trap	59K734028	
A4	Trimmer Cap.	20A736287	Video IF Input Trimmer (20-140MMF)
	Cabinet	16K737267	Models 21K37B, Y21K37B
	Cabinet	16K737450	Models 21K37BR, Y21K37BR
	Cabinet	16K736686	Models 21K39, Y21K39
	Cabinet	16K736687	Models 21K39B, Y21K39B
	Cabinet	16F736667	Models 21K40, Y21K40
	Cabinet	16K736668	Models 21K40B, Y21K40B
	Cabinet	16K737455	Models 21T26B, Y21T26B
	Cabinet	16K737456	Models 21T26BR, Y21T26BR
	Cabinet	16K737457	Models 21T26CH, Y21T26CH
	Cabinet	16K737133	Models 21T27B, Y21T27B
	Cabinet	16K737132	Models 21T27MA, Y21T27MA
	Cabinet	16K737451	Models 21T27PK, Y21T27PK
	Cabinet	16E736657	Models 21T28, Y21T28
	Cabinet	16K736658	Models 21T28B, Y21T28B
	Cabinet	16E736952	Models 24K9, Y24K9
	Cabinet	16K736953	Models 24K9B, Y24K9B
	Cabinet	16K737449	Models 24T3BR, Y24T3BR
	Knob	36B736235	Contrast - All models
	Knob	36K736677	Fine tuning - Models 21K37B, BA, BR, BRA, Y21K37B, BA, BRA, 21T26B, BR, Y21T26B, BR
	Knob	36K737373	Fine tuning - Models 21K39, B, 21K40, B, Y21K39, B, Y21K40, B, 21T27B, MA, PK, Y21T27B, MA, PK, 21T28, B, Y21T28, B, 24K9, B, Y24K9, B, 24T3BR, Y24T3BR
	Knob	36A736676	Fine tuning - Models 21T26CH, Y21T26CH
	Knob	36B736985	Horiz. Hold, Vert. Hold, Brightness - Models 21K37B, BA, BR, BRA, Y21K37B, BA, BR, BRA, 21T26B, BR, Y21T26B, BR
	Knob	36A736249	Horiz. Hold, Vert. Hold, Brightness - Models 21K39, B, 21K40, B, Y21K39, B, Y21K40, B, 21T28, B, Y21T28, B, 24K9, B, Y24K9, B, 24T3BR, Y24T3BR, 21T27B, MA, PK, Y21T27B, MA, PK
	Knob	36K736986	Horiz. Hold, Vert. Hold, and Brightness - Models 21T26CH, Y21T26CH
	Knob	36B736987	On-off-volume - Models 21K37B, BA, BR, BRA, Y21K37B, BA, BR, BRA, 21T26B, BR, Y21T26B, BR
	Knob	36K736988	On-off-volume - Models 21T26CH, Y21T26CH
	Knob	36K737374	On-off-volume - Models 21K39, B, 21K40, B, Y21K39, B, Y21K40, B, 21T27B, MA, PK, Y21T27B, MA, PK, 21T28, B, Y21T28, B, 24K9, B, Y24K9B, 24T3BR, Y24T3BR
	Knob	36K736246	VHF Channel Selector - Models 21K37B, BR, 21T26B, BR
	Knob	36K736245	VHF Channel Selector - Models Y21K37B, BR, Y21T26B, BR
	Knob	36K736244	VHF Channel Selector - Models 21K39, B, 21K40, B, 21T27B, MA, PK, 21T28, B, 24K9, B, 24T3BR
	Knob	36C736243	VHF Channel Selector - Models Y21K39, B, Y21K40, B, Y21T27B, MA, PK, Y21T28, B, Y24K9, B, Y24T3BR
	Knob	36K736248	VHF Channel Selector - Model 21T26CH
	Knob	36K736247	VHF Channel Selector - Model Y21T26CH
	Scale	34C736236	UHF Dial - Models Y21K37B, BR, Y21K39, B, Y21K40, B, Y21T26B, BR, CH, Y21T27B, MA, PK, Y21T28, B, Y24K9, B, Y24T3BR
	Safety Glass	61K736858	Models 21K37B, BA, BR, BRA, Y21K37B, BA, BR, BRA, 21T26B, BA, BR, BRA, CH, CHA, Y21T26B, BA, BR, BRA, CH, CHA
	Safety Glass	61K736132	Models 21K39, B, 21K40, B, Y21K39, B, Y21K40, B 21T27B, MA, PK, Y21T27B, MA, PK, 21T28, B, Y21T28, B,
	Safety Glass	61K736133	Models 24K9, B, Y24K9, B, 24T3BR, Y24T3BR


1ST VIDEO IF
6BZ6
2ND VIDEO IF
6BZ6
3RD VIDEO IF
6CB6
VIDEO OUTPUT
12BY7
AGC KEYING
6AU6
CATH
(IF INPUT) TO L25
TP-7
(SOUND TAKE-OFF) TO C77
4.5MC (MIN)
(VIDEO OUTPUT) TO JUNCT. OF R64, R62 & C69
CHASSIS TS 534D
CHASSIS TS 534D-06-09
CONTRAST CONTROL 350Ω
TP-1
TP-2
TP-3
TP-4
TO PIN 3 OF V14 (SYNC SEP)
TO 145V LINE
(SYNC TAKE-OFF) TO C93
(BOOST VOLTAGE) TO JUNCT. OF TERM. 2 OF T2 & PIN 10 OF V20
(RF AGC) TO R22
TO TERM 3 OF T3 (HORIZ TRANSFORMER)
CHASSIS TS 534D-06
68K OR 82K
TO 145V LINE
CHASSIS TS 534D-09
TO JUNCT. R109 & R110
(MIXER) TO PIN 6 OF V3A
(1ST VIDEO IF) TO PIN 1 OF V4
TO JUNCT. OF R37 & C46
245V
115V
.2V
1V
170V
135V
0V
1.5V
130V
140V
3.4V
80V
.75V
20-140 MMF
1 MMF
22 MMF
470 MMF
47Ω
1000 MMF
6.8K
18K
1K
.25
560 MMF
47K
800 MMF
120Ω
330K
1.2K
8.2K
39K
.1
5.6 MMF
3.9 MMF
3.3K
3.9K
68 MMF
30 MFD
5000 MMF
2.7K
470Ω
27MMF
10K
5K
12K
33K
1.8K
4.3K
1 MEG
1.2 MEG
8.2 MEG
470MMF
180K
68K
.01
4.7 MMF
18 MMF
2.2 MMF
47 MMF

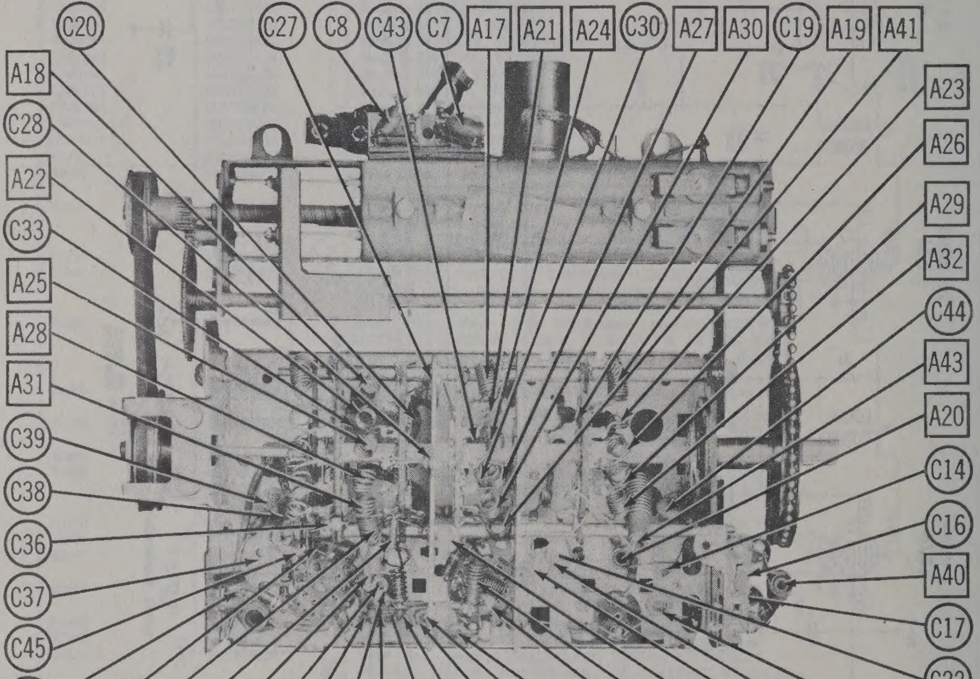
VIDEO IF AND AGC CIRCUIT USED IN CHASSIS TS-534C, AND TS-534 D

VIDEO IF INPUT CIRCUIT USED WITH CHASSIS TS-534D

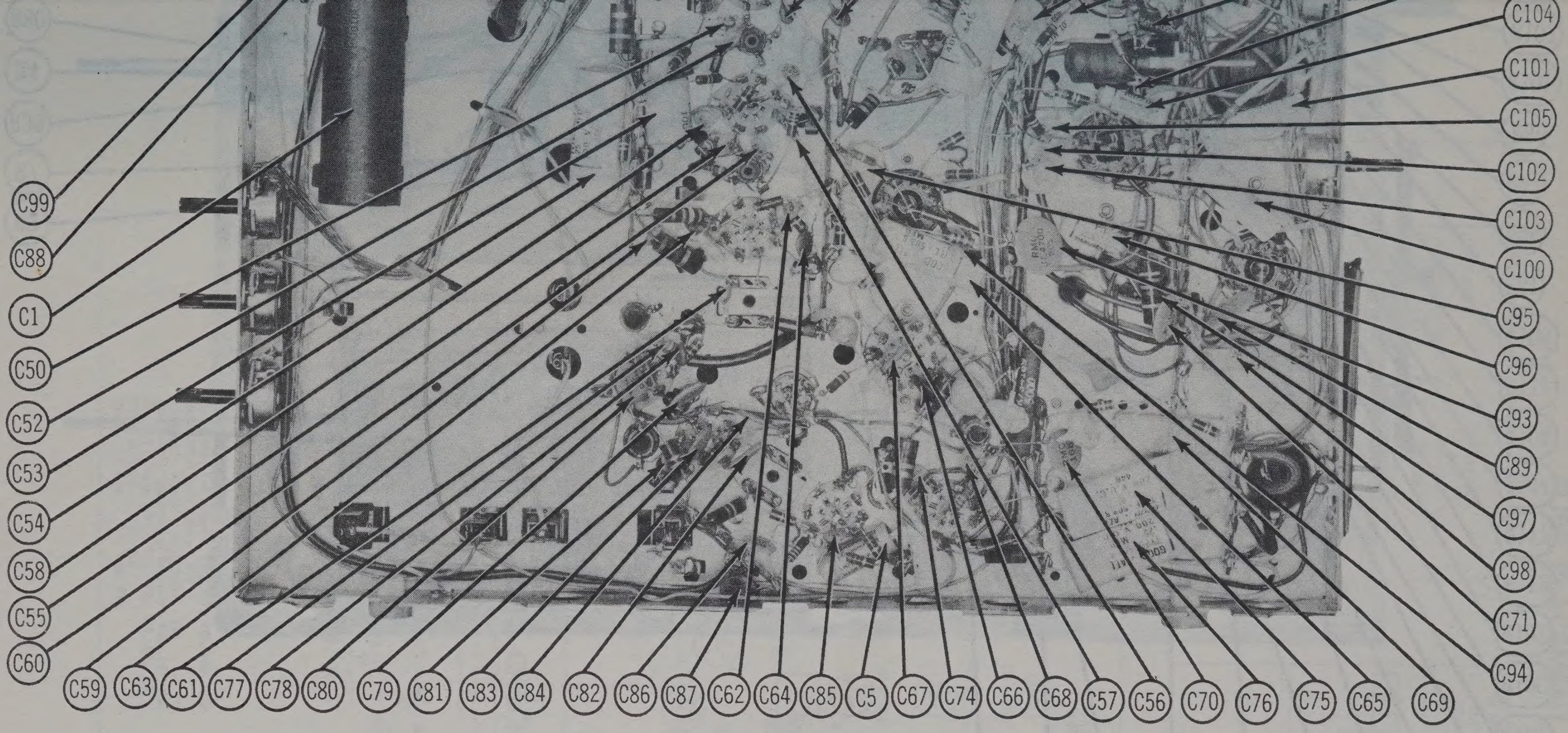
ALTERNATE VIDEO IF AND AGC CIRCUIT SCHEMATIC


R10
R9
R25
L24
L21
R34
R27
R28
L23
R33
L18
R22
R24
L13
L19
R21
L12
L14
L10
R20
L8
L11
L9
R23
R29
L25
R32
R26
L15
R30
R31
L20
L22
L17
R19
L16

VHF-UHF TUNER BOTTOM VIEW


C20
C27
C8
C43
C7
A17
A21
A24
C30
A27
A30
C19
A19
A41
A18
C28
A22
C33
A25
A28
A31
C39
C38
C36
C37
C45
C41
C35
A23
A26
A29
A32
C44
A43
A20
C14
C16
A40
C17
C22
C15
A42
C32
C31
C34
C40
A16
E
C26
A14
C25
A15
C21
C24
A13
C29
C23
C18

VHF-UHF TUNER BOTTOM VIEW

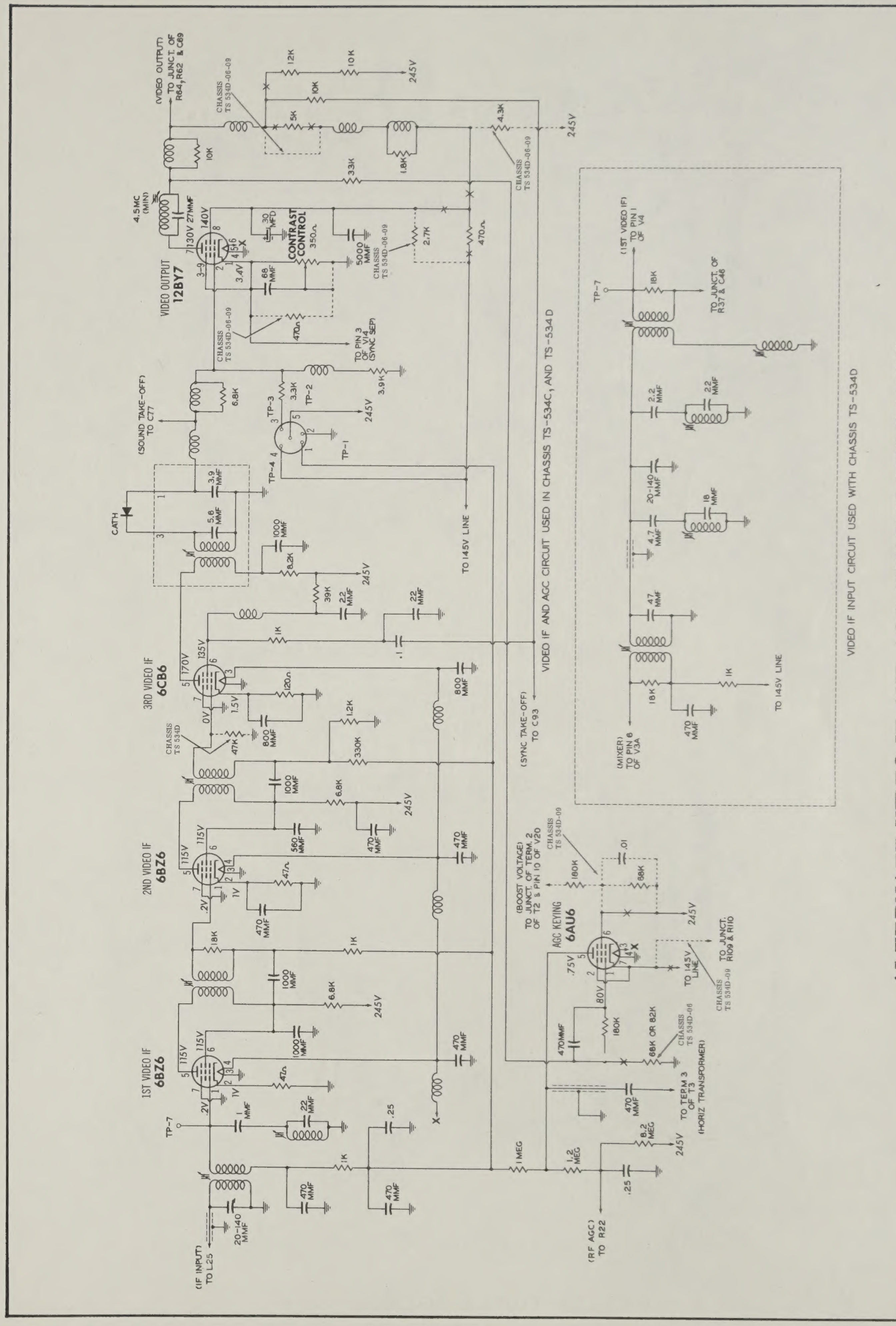

C99
C88
C1
C50
C52
C53
C54
C58
C55
C60
C59
C63
C61
C77
C78
C80
C79
C81
C83
C84
C82
C86
C87
C62
C64
C85
C5
C67
C74
C66
C68
C57
C56
C70
C76
C75
C65
C69
C104
C101
C105
C102
C103
C100
C95
C96
C93
C89
C97
C98
C71
C94

CHASSIS BOTTOM VIEW-CAPACITOR IDENTIFICATION

MOTOROLA MODELS Y21K37B, BA, BR, BRA, Y21K39, B, Y21K40, B, Y21T26B, BA, BR, BRA, CH, CHA, Y21T27B, MA, PK, Y21T28, B, 21K37B, BA, BR, BRA, 21K39, B, 21K40, B, 21T26B, BA, BR, BRA, CH, CHA, 21T27B, MA, PK, 21T28, B (Ch. TS-534, Y, YB)

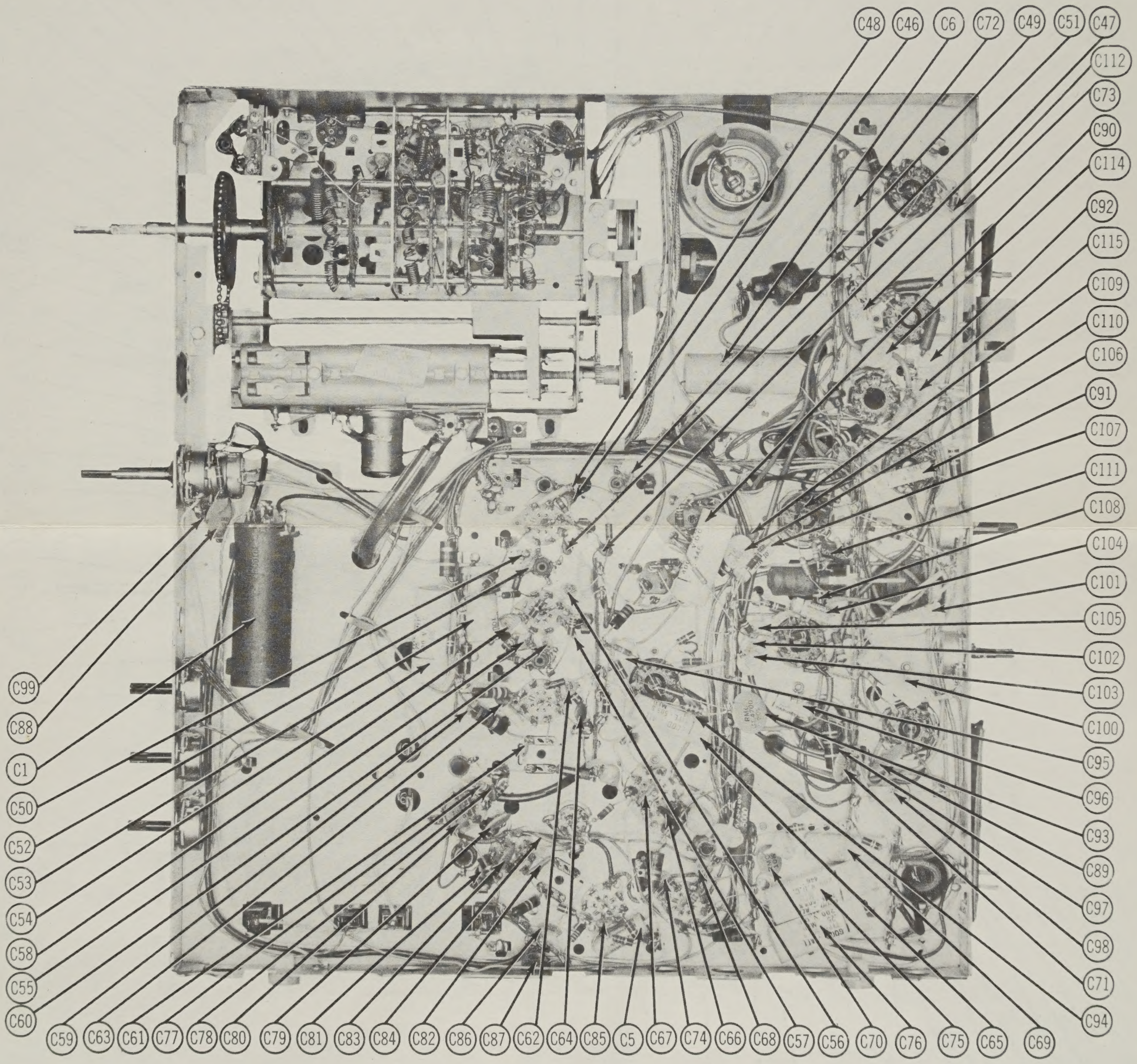
PRODUCTION CHANGES (cont)

Ch. TS-534D-03	TO INCREASE AUDIO SENSITIVITY R70 is omitted. A shield is added under the ratio detector transformer (L44). The components are relocated and dressed close to the chassis.
Ch. TS-534D-04	TO PREVENT CAPACITOR BREAKDOWN The negative side of C6 is removed from the junction of C2C, R95 and R6 , and reconnected to the 245 volt line. ELECTROLYTIC ADDED A 20MFD, 500V electrolytic capacitor (part #23K710667) is added from the high side of the vertical linearity control (R6) to the 245 volt line.
Ch. TS-534D-05	TO REDUCE SLIPPAGE To reduce slippage, tension is applied to the drive belt by adding a roller and spring assembly. This change applies only to UHF models.
Ch. TS-534D-06, -0	TO IMPROVE CONTRAST The video amplifier circuit has been revised. A partial schematic is shown on page 17. COMPONENT CHANGE R115 is increased from 680Ω to 1KΩ.
Ch. TS-534D-07, -0	COMPONENT CHANGE The 470Ω resistor added across the contrast control (R4A) in change "D-06" is decreased to 220Ω. R115 is decreased from 1KΩ to 680Ω. In change "D-07-0", R115 is increased to 1KΩ.
Ch. TS-534D-08, -0	TO REDUCE FILAMENT VOLTAGE ON 1B3 R118 is increased from 3.3Ω to 4.7Ω. R115 is decreased to 680Ω. In change "D-08-0" R115 is increased to 1KΩ.
Ch. TS-534D-09, -0	TO IMPROVE SYNC The AGC circuit has been revised. A partial schematic is shown on page 17 showing the new arrangement. In change "D-09-0", R115 is increased to 1KΩ.


VIDEO OUTPUT 12BY7
CONTRAST CONTROL
3RD VIDEO IF 6CB6
2ND VIDEO IF 6BZ6
1ST VIDEO IF 6BZ6
AGC KEYING 6AU6
(IF INPUT) TO L25
(RF AGC) TO R22
(VIDEO OUTPUT) TO JUNCT. OF R64, R62 & C89
(SOUND TAKE-OFF) TO C77
(SYNC TAKE-OFF) TO C93
(BOOST VOLTAGE) TO JUNCT. OF TERM. 2 OF T2 & PIN 10 OF V20
TO TERM 3 OF T3 (HORIZ TRANSFORMER)
TO 145V LINE
245V
4.5MC (MIN)
CATH
TP-1
TP-2
TP-3
TP-4
TP-7
VIDEO IF AND AGC CIRCUIT USED IN CHASSIS TS-534C, AND TS-534 D
VIDEO IF INPUT CIRCUIT USED WITH CHASSIS TS-534D
(1ST VIDEO IF) TO PIN 1 OF V4
(MIXER) TO PIN 6 OF V3A
TO JUNCT. OF R37 & C46
TO JUNCT. R109 & R110
CHASSIS TS 534D-06-09

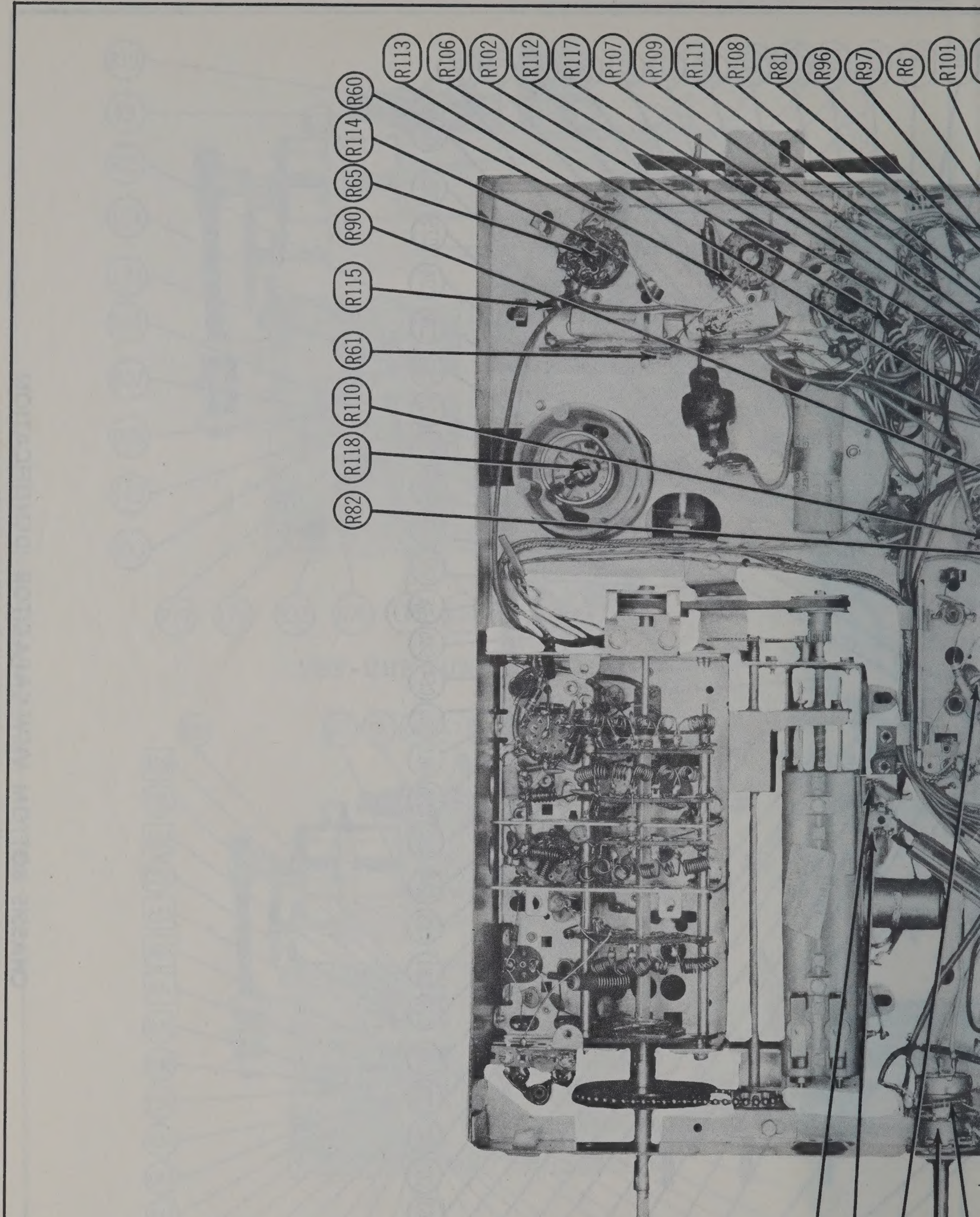
ALTERNATE VIDEO IF AND AGC CIRCUIT SCHEMATIC

MOTOROLA MODELS Y21K37B, BA, BR, BRA, Y21K39, B, Y21K40, B, Y21T26B, BA, BR, BRA, CH, CHA, Y21T27B, MA, PK, Y21T28, B, 21K37B, BA, BR, BRA, 21K39, B, 21K40, B, 21T26B, BA, BR, BRA, CH, CHA, 21T27B, MA, PK, 21T28, B (Ch. TS-534, Y, YB)

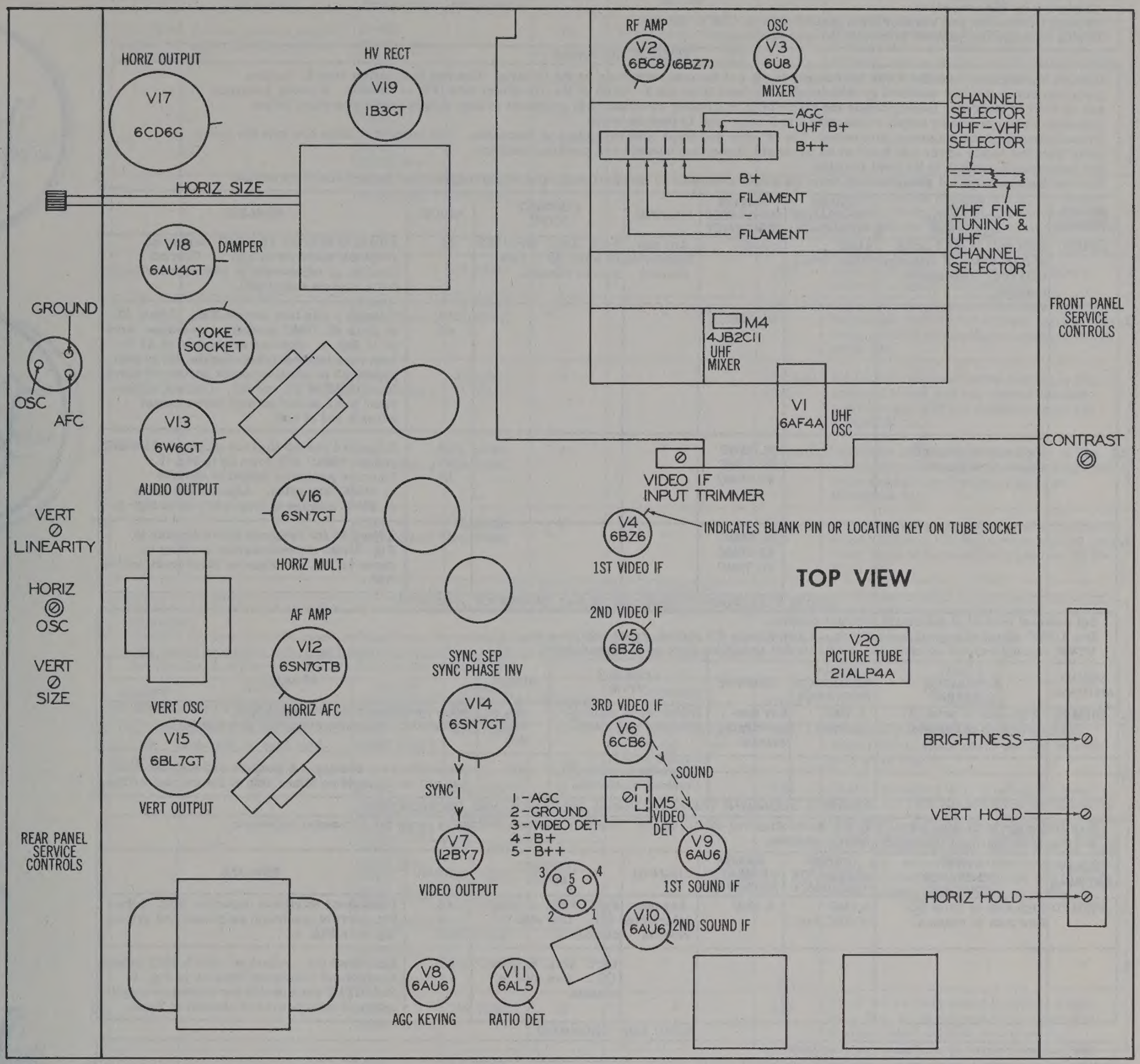

C48
C46
C6
C72
C49
C51
C47
C112
C73
C90
C114
C92
C115
C109
C110
C106
C91
C107
C111
C108
C104
C101
C105
C102
C103
C100
C95
C96
C93
C89
C97
C98
C71
C94
C99
C88
C1
C50
C52
C53
C54
C58
C55
C60
C59
C63
C61
C77
C78
C80
C79
C81
C83
C84
C82
C86
C87
C62
C64
C85
C5
C67
C74
C66
C68
C57
C56
C70
C76
C75
C65
C69

CHASSIS BOTTOM VIEW-CAPACITOR IDENTIFICATION

MOTOROLA MODELS Y21K37B, BA, BR, BRA, Y21K39, B, Y21K40, B, Y21T26B, BA, BR, BRA, CH, CHA, Y21T27B, MA, PK, Y21T28, B, 21K37B, BA, BR, BRA, 21K39, B, 21K40, B, 21T26B, BA, BR, BRA, CH, CHA, 21T27B, MA, PK, 21T28, B (Ch. TS-534, Y, YB)


R113
R106
R102
R112
R117
R107
R109
R111
R108
R81
R96
R97
R6
R101
R60
R114
R65
R90
R115
R61
R110
R118
R82
R8
R7
R39
R4

TUBE PLACEMENT CHART


HORIZ OUTPUT
V17
6CD6G
HV RECT
V19
1B3GT
RF AMP
V2
6BC8 (6BZ7)
OSC
V3
6U8
MIXER
AGC
UHF B+
B++
B+
FILAMENT
-
FILAMENT
CHANNEL SELECTOR UHF-VHF SELECTOR
VHF FINE TUNING & UHF CHANNEL SELECTOR
HORIZ SIZE
V18
6AU4GT
DAMPER
GROUND
OSC
AFC
YOKE SOCKET
M4
4JB2C11
UHF MIXER
FRONT PANEL SERVICE CONTROLS
V1
6AF4A
UHF OSC
CONTRAST
V13
6W6GT
AUDIO OUTPUT
VIDEO IF INPUT TRIMMER
V16
6SN7GT
HORIZ MULT
V4
6BZ6
INDICATES BLANK PIN OR LOCATING KEY ON TUBE SOCKET
1ST VIDEO IF
VERT LINEARITY
HORIZ OSC
VERT SIZE
TOP VIEW
AF AMP
V12
6SN7GTB
HORIZ AFC
2ND VIDEO IF
V5
6BZ6
V20
PICTURE TUBE
21ALP4A
VERT OSC
V15
6BL7GT
VERT OUTPUT
SYNC SEP
SYNC PHASE INV
V14
6SN7GT
3RD VIDEO IF
V6
6CB6
BRIGHTNESS
SOUND
SYNC
M5
VIDEO DET
1-AGC
2-GROUND
3-VIDEO DET
4-B+
5-B++
V9
6AU6
VERT HOLD
REAR PANEL SERVICE CONTROLS
V7
12BY7
VIDEO OUTPUT
1ST SOUND IF
HORIZ HOLD
3
4
5
2
1
V10
6AU6
2ND SOUND IF
V8
6AU6
AGC KEYING
V11
6AL5
RATIO DET

MOTOROLA MODELS Y21K37B, BA, BR, BRA, Y21K39, B, Y21K40, B, Y21T26B, BA, BR, BRA, CH, CHA, Y21T27B, MA, PK, Y21T28, B, 21K37B, BA, BR, BRA, 21K39, B, 21K40, B, 21T26B, BA, BR, BRA, CH, CHA, 21T27B, MA, PK, 21T28, B (Ch. TS-534, Y, YB)

TUBE FAILURE CHECK CHART

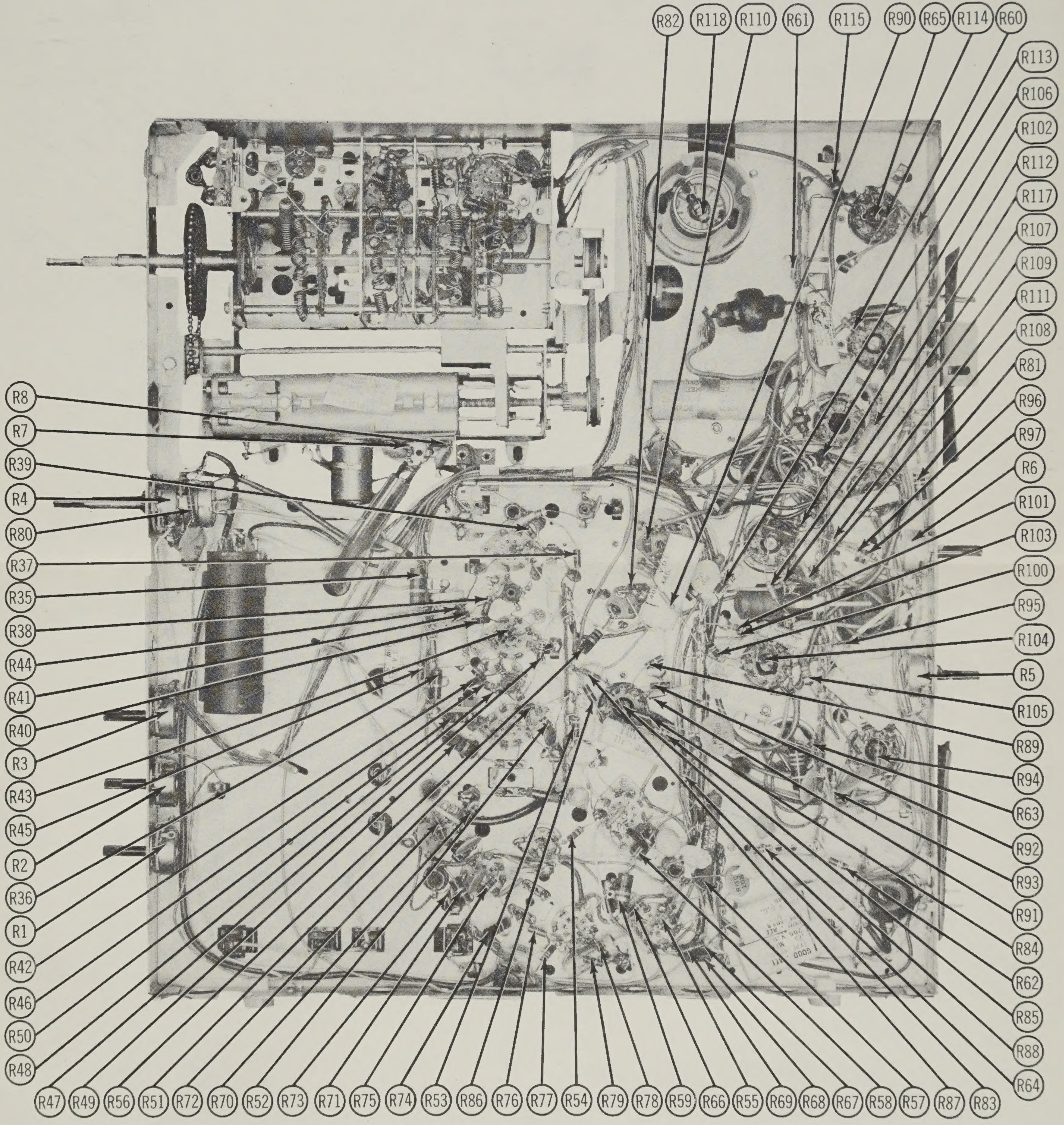
The following chart lists tubes whose failures are most likely to produce the indicated symptoms. Refer to tube placement chart for location and type of tube.

POWER SUPPLY FAILURE
No raster, no sound - **Selenium Rectifiers (M1 & M2)**

LOSS OF PICTURE OR SOUND
No pic, no sound, has raster - V3, V4, V5, V6, V13 (V1 UHF only)
No pic, no sound, has snow - V2, V3, V4
No pic, has sound, has raster - V7, V8, V20
Has pic, no sound - V9, V10, V11, V12, V13
Overloaded picture - V8

SYNC FAILURE
No vert. sync - V14, V15
No horiz. sync - V12, V14, V16
No vert. or horiz. sync - V14

SWEEP FAILURE
No raster, has sound - V16, V17, V18, V19, V20
No vertical deflection - V15
Poor vert. linearity or foldover - V15
Poor horiz. linearity or foldover - V16, V17, V18
Narrow picture - V16, V17, V18, V19, M1, M2
Vert. off freq. - V14, V15
Horiz. off freq. - V12, V14, V16


R82
R118
R110
R61
R115
R90
R65
R114
R60
R113
R106
R102
R112
R117
R107
R109
R111
R108
R81
R96
R97
R6
R101
R103
R100
R95
R104
R5
R105
R89
R94
R63
R92
R93
R91
R84
R62
R85
R88
R64
R8
R7
R39
R4
R80
R37
R35
R38
R44
R41
R40
R3
R43
R45
R2
R36
R1
R42
R46
R50
R48
R47
R49
R56
R51
R72
R70
R52
R73
R71
R75
R74
R53
R86
R76
R77
R54
R79
R78
R59
R66
R55
R69
R68
R67
R58
R57
R87
R83

CHASSIS BOTTOM VIEW-RESISTOR IDENTIFICATION

MOTOROLA MODELS Y21K37B, BA, BR, BRA, Y21K39, B, Y21K40, B, Y21T26B, BA, BR,
BRA, CH, CHA, Y21T27B, MA, PK, Y21T28, B, 21K37B, BA, BR, BRA, 21K39, B, 21K40,
B, 21T26B, BA, BR, BRA, CH, CHA, 21T27B, MA, PK, 21T28, B (Ch. TS-534, Y, YB)

ALIGNMENT INSTRUCTIONS

ALIGNMENT INSTRUCTIONS—READ CAREFULLY BEFORE ATTEMPTING ALIGNMENT

The high voltage shock hazard may be eliminated by disconnecting the yoke socket. The possibility of RF interference during alignment is also eliminated by this procedure.
Connect a 2500Ω/25 watt resistor from positive side of C3A to chassis.
Use an isolation transformer to protect the test equipment.

VIDEO IF ALIGNMENT

Connect the negative lead of a 6 volt bias supply to pin 1 of the test receptacle on the IF strip. Connect the positive lead to chassis.
Local oscillator may be disabled by connecting a clip lead from pin 9 (grid) of the osc-mixer tube (V3) to chassis. If sweep generator has no built-in markers, loosely couple the output of an accurately calibrated AM generator to high side of sweep generator output.
Attenuate sweep generator output to maintain 3 to 5 volts peak to peak on scope.
Preset adjustment A7 maximum clockwise. The IF coils and traps have two points of resonance. The correct settings are with the cores away from the center of the coil form so as not to affect coupling between coil and trap windings.
Set area selector switch to its local position.
Connect the synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
1.	.001MFD	High side to pin 1 (grid) of first video IF amplifier tube (V4). Low side to chassis.	44MC (10MC Swp.)	42.25	Any non-interfering channel	Vert. Amp. thru 47KΩ to point Ⓐ. Low side to chassis.	A1	Adjust A1 to place 42.25MC marker on response curve as in Fig. 1. Correct position of adjustment is with core farthest from chassis end of coil.
2.	"	"	"	45.75MC	"	"	A2, A3	Connect a clip lead across R30. Adjust A2 to place 45.75MC marker on response curve as in Fig. 1. Correct adjustment of A2 is with core farthest from chassis end of coil. Adjust A3 to position center portion of curve for MINIMUM tilt and dip. Correct adjustment of A3 should be with core nearest chassis end of coil.
3.	"	High side to point Ⓑ. Low side to chassis.	"	41.25MC 42.25MC 45.75MC	"	"	A4, A5, A6	Adjust A4 and A5 to place markers (42.25MC and 45.75MC) 30% down as in Fig. 2. Increase generator output to observe 41.25MC trap notch. Adjust A6 to place 41.25MC marker in trap notch as in Fig. 2.
4.	"	"	"	41.25MC 42.25MC 45.75MC	"	"	A7	Adjust A7 for response curve similar to Fig. 3 with correct marker position as shown in Fig. 3. Remove short from across R30.

SOUND IF ALIGNMENT USING AM SIGNAL GENERATOR AND VTVM

Set contrast control at maximum contrast position.
If a 4.5MC signal of crystal accuracy is not available, a TV station signal may be used.
VTVM connections and adjustments of A8 thru A11 should be made as in steps 5 and 6.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	CHANNEL	CONNECT VTVM	ADJUST	REMARKS
5.	.005MFD	High side to point Ⓐ. Low side to chassis.	4.5MC (Unmod.)	Any non-interfering channel	DC probe to point Ⓒ. Common to chassis.	A8, A9, A10	Adjust for maximum deflection with VTVM set to 5 volt scale. Attenuate generator as necessary.
6.	"	"	"	"	DC probe to point Ⓓ. Common to chassis.	A11	Adjust for zero reading. A positive and negative reading will be obtained on either side of the correct setting.

SOUND IF ALIGNMENT USING FM SIGNAL GENERATOR AND OSCILLOSCOPE

Use frequency modulated signal with 60∿ modulation and 450KC sweep. Use 120∿ sawtooth voltage in scope for horizontal deflection.
Set contrast control at maximum contrast position.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
5.	.005MFD	High side to point Ⓐ. Low side to chassis.	4.5MC (450KC Swp.)	4.5MC	Any non-interfering channel	Vert. Amp. to point Ⓒ. Low side to chassis.	A8, A9, A10	Disconnect stabilizer capacitor (C5). Adjust for curve of maximum amplitude and symmetry as in Fig. 4.
6.	"	"	"	"	"	Vert. Amp. to point Ⓓ. Low side to chassis.	A11	Reconnect C5. Adjust so that 4.5MC occurs at center of crossover lines as in Fig. 5. SLIGHTLY retouch A10 for maximum amplitude and straightness of crossover lines.

4.5MC TRAP ALIGNMENT

Set contrast control at maximum contrast position.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	CHANNEL	CONNECT VTVM	ADJUST	REMARKS
7.	.005MFD	High side to point Ⓐ. Low side to chassis.	4.5MC (Unmod.)	Any non-interfering channel	DC probe thru detector (Fig. 6) to pin 11 (cathode) of picture tube. Low side to chassis.	A12	Adjust for MINIMUM deflection on VTVM.

ALTERNATE 4.5MC TRAP ALIGNMENT

Tune in a local TV station. Adjust the fine tuning control until a noticeable 4.5MC beat appears in the picture. Adjust A12 for minimum 4.5MC beat in the picture. Adjust A12 so that core is approximately centered between the points where the 4.5MC beat appeared in the picture.

VHF RF AND MIXER ALIGNMENT

Adjust the oscilloscope for a 2 inch deflection with 1.5 volt peak to peak signal.
If sweep generator has no built-in marker, loosely couple a separate marker generator to the antenna terminals.
Adjustments A17, A18, A19 and A21 thru A32 are adjusted by expanding or compressing coil turns.
Connect the synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.
The sweep generator output lead should be terminated with its characteristic impedance, usually 50Ω.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
8.	Two 120Ω Carbon Resistors	Across antenna terminals with 120Ω in each lead.	213MC (10MC Swp.)	211.25MC 215.75MC	13	Vert. Amp. thru 47KΩ to point Ⓑ. Low side to chassis.	A13, A14	Preset adjustments A15 and A16 at mid-capacity. Preset adjustment A40 for maximum inductance (core fully clockwise). Preset A20 for MINIMUM inductance (core fully counter clockwise). Adjust A13 and A14 for maximum amplitude and response similar to Fig. 7.
9.	"	"	177MC (10MC Swp.)	175.25MC 179.75MC	7	"	A15, A16	Adjust for maximum amplitude, correct tilt, and correct marker position as in Fig. 7.

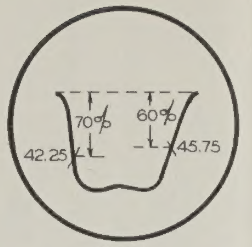


FIG. 1

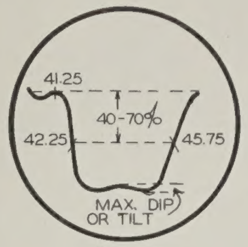


FIG. 2

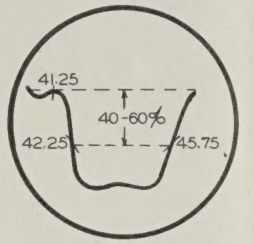


FIG. 3

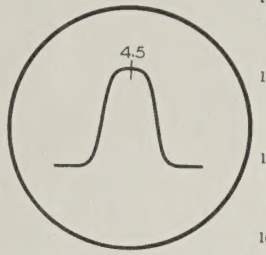


FIG. 4

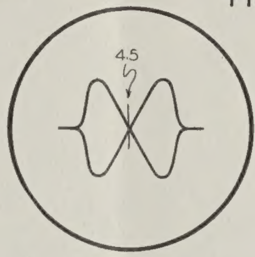


FIG. 5

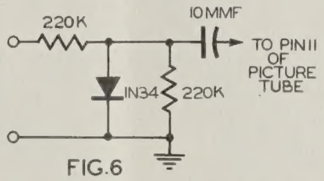


FIG. 6

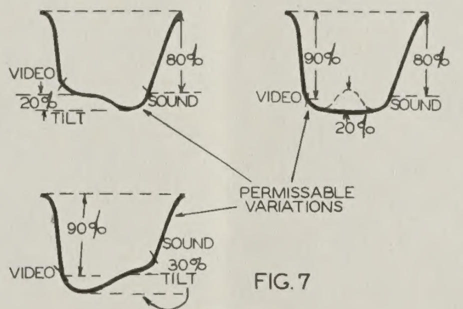


FIG. 7

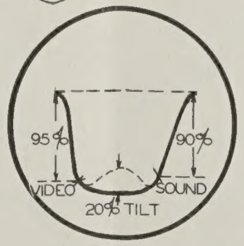


FIG. 8

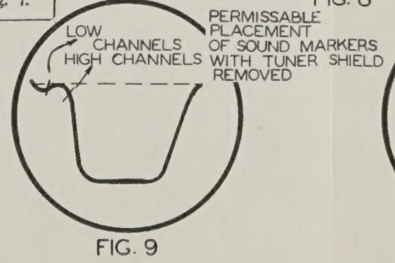


FIG. 9

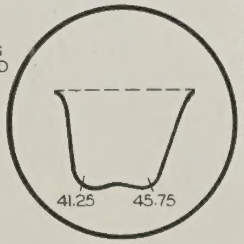


FIG. 10

VHF RF AND MIXER ALIGNMENT (Cont.)

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
10.	Two 120Ω carbon resistors	Across antenna terminals with 120Ω in each lead.	207MC (10MC Swp.) 201MC (10MC Swp.) 195MC (10MC Swp.) 189MC (10MC Swp.) 183MC (10MC Swp.)		12 11 10 9 8	Vert. Amp. thru 47KΩ to point Ⓑ. Low side to chassis.		Check for response curve on each channel. If response is not within limits on each channel, repeat steps 8 and 9. If necessary, make compromise adjustments of A13 thru A16.
11.	"	"	85MC (10MC Swp.)	83.25MC 87.75MC	6	"	A17, A18, A19	Adjust A17, A18 and A19 in this order for response curve similar to Fig. 8. Adjust A17 and A18 for correct marker position. Adjust A19 for maximum gain and MINIMUM tilt.
12.	"	"	"	87.75MC	6	"	A20	Adjust A20 until response curve is just effected at sound marker point.
13.	"	"	79MC (10MC Swp.)	77.25MC 81.75MC	5	"	A21, A22, A23	Adjust for response curve similar to Fig. 8. Adjust A21 and A22 for correct marker positions and A23 for maximum gain and MINIMUM tilt.
14.	"	"	69MC (10MC Swp.)	67.25MC 71.75MC	4	"	A24, A25 A26	Adjust for response curve similar to Fig. 8. Adjust A24 and A25 for correct marker positions and A26 for maximum gain and MINIMUM tilt.
15.	"	"	63MC (10MC Swp.)	61.25MC 65.75MC	3	"	A27, A28, A29	Adjust for response curve similar to Fig. 8. Adjust A27 and A28 for correct marker positions and A29 for maximum gain and MINIMUM tilt.
16.	"	"	57MC (10MC Swp.)	55.25MC 59.75MC	2	"	A30, A31, A32	Adjust for response curve similar to Fig. 8. Adjust A30 and A31 for correct marker positions and A32 for maximum gain and MINIMUM tilt.

VHF OSCILLATOR ALIGNMENT

Replace the 6 volt bias as under "Video IF Alignment". Use only enough sweep generator output from generator to produce useable pattern on scope.
Connect the synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.
The sweep generator output lead should be terminated with its characteristic impedance, usually 50Ω.
Set the fine tuning control to the mid-position of its range.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
17.	Two 120Ω Carbon Resistors	Across antenna terminals with 120Ω in each lead.	207MC (10MC Swp.)	209.75MC	12	Vert. Amp. thru 47KΩ to point Ⓐ. Low side to chassis.	A33	Preset adjustment A34 at mid-capacity. Adjust A33 to place sound marker in sound trap as in Fig. 9.
18.	"	"	213MC (10MC Swp.) 207MC (10MC Swp.) 201MC (10MC Swp.) 195MC (10MC Swp.) 189MC (10MC Swp.) 183MC (10MC Swp.) 177MC (10MC Swp.)	215.75MC 209.75MC 203.75MC 197.75MC 191.75MC 185.75MC 179.75MC	13 12 11 10 9 8 7	"	A34	Check channels 7 thru 13 noting if sound marker for each channel falls just above the trap notch. If more than a 30 degree rotation of fine tuning control is necessary to place sound marker in proper position on any high band, set sweep and marker generator for channel 7 frequency and adjust A34 to place sound marker in trap notch as in Fig. 9.
19.	"	"	213MC (10MC Swp.)	215.75MC	13	"	A33	Check for correct sound marker position as in Fig. 9. If necessary, readjust A33 to place sound marker in trap notch.
20.	"	"	85MC (10MC Swp.) 79MC (10MC Swp.) 69MC (10MC Swp.) 63MC (10MC Swp.) 57MC (10MC Swp.)	87.75MC 81.75MC 71.75MC 65.75MC 59.75MC	6 5 4 3 2	"	A35 A36 A37 A38 A39	Adjust to place sound marker in sound trap as in Fig. 9. A35 thru A39 are adjusted by expanding or compressing coil turns.

45.0MC TRAP ALIGNMENT

Connect the synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
21.	Two 120Ω Carbon Resistors	Across antenna terminals with 120Ω in each lead.	45MC (10MC Swp.)	45MC	2	Vert. Amp. thru 47KΩ to point Ⓐ. Low side to chassis.	A40	Increase sweep generator output to produce visible marker on scope. Adjust A40 for MINIMUM response at 45MC.

UHF ALIGNMENT

Connect the synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
22.	Direct	High side to point Ⓔ. Low side to chassis.	44MC (10MC Swp.)	41.25MC 45.75MC	UHF	Vert. Amp. to point Ⓑ. Low side to chassis.	A41, A42, A43	Adjust A41, A42, and A43 for response similar to Fig. 10. Adjust A41 and A42 for correct marker position and A43 for maximum gain and MINIMUM tilt. A41 and A42 are adjusted by expanding or compressing coil turns.

IF SENSITIVITY MEASUREMENT

Set the contrast control for minimum contrast. Disable the horizontal sweep circuit as under "Pre-alignment Instructions".
Set the local-distance switch to "distance-position". Set channel selector to channel 13. Connect the high side of an AM signal generator thru a .001 MFD to pin 1 (grid) of first video IF amplifier tube (V4). Low side to chassis. Set signal generator to 45.0MC.
Connect the DC probe of a VTVM to point Ⓐ. Common to chassis.
A signal of less than 400 microvolts from the generator should produce one volt on VTVM. Short out R30 with a clip lead and move high side of signal generator to point Ⓑ. Low side to chassis. A signal of less than 60 microvolts from the generator should produce one volt on VTVM. Remove short from R30.

ALIGNMENT INSTRUCTIONS—READ CAREFULLY BEFORE ATTEMPTING ALIGNMENT

The high voltage shock hazard may be eliminated by disconnecting the yoke socket. The possibility of RF interference during alignment is also eliminated by this procedure.
Connect a 2500Ω/25 watt resistor from positive side of C3A to chassis.
Use an isolation transformer to protect the test equipment.

VIDEO IF ALIGNMENT

Connect the negative lead of a 6 volt bias supply to pin 1 of the test receptacle on the IF strip. Connect the positive lead to chassis.
Local oscillator may be disabled by connecting a clip lead from pin 9 (grid) of the osc-mixer tube (V3) to chassis. If sweep generator has no built-in markers, loosely couple the output of an accurately calibrated AM generator to high side of sweep generator output.
Attenuate sweep generator output to maintain 3 to 5 volts peak to peak on scope.
Preset adjustment A7 maximum clockwise. The IF coils and traps have two points of resonance. The correct settings are with the cores away from the center of the coil form so as not to affect coupling between coil and trap windings.
Set area selector switch to its local position.
Connect the synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
1.	.001MFD	High side to pin 1 (grid) of first video IF amplifier tube (V4). Low side to chassis.	44MC (10MC Swp.)	42.25	Any non-interfering channel	Vert. Amp. thru 47KΩ to point ⟨A⟩. Low side to chassis.	A1	Adjust A1 to place 42.25MC marker on response curve as in Fig. 1. Correct position of adjustment is with core farthest from chassis end of coil.
2.	"	"	"	45.75MC	"	"	A2, A3	Connect a clip lead across R30. Adjust A2 to place 45.75MC marker on response curve as in Fig. 1. Correct adjustment of A2 is with core farthest from chassis end of coil. Adjust A3 to position center portion of curve for MINIMUM tilt and dip. Correct adjustment of A3 should be with core nearest chassis end of coil.
3.	"	High side to point ⟨B⟩. Low side to chassis.	"	41.25MC 42.25MC 45.75MC	"	"	A4, A5, A6	Adjust A4 and A5 to place markers (42.25MC and 45.75MC) 30% down as in Fig. 2. Increase generator output to observe 41.25MC trap notch. Adjust A6 to place 41.25MC marker in trap notch as in Fig. 2.
4.	"	"	"	41.25MC 42.25MC 45.75MC	"	"	A7	Adjust A7 for response curve similar to Fig. 3 with correct marker position as shown in Fig. 3. Remove short from across R30.

SOUND IF ALIGNMENT USING AM SIGNAL GENERATOR AND VTVM

Set contrast control at maximum contrast position.
If a 4.5MC signal of crystal accuracy is not available, a TV station signal may be used.
VTVM connections and adjustments of A8 thru A11 should be made as in steps 5 and 6.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	CHANNEL	CONNECT VTVM	ADJUST	REMARKS
5.	.005MFD	High side to point ⟨A⟩. Low side to chassis.	4.5MC (Unmod.)	Any non-interfering channel	DC probe to point ⟨C⟩. Common to chassis.	A8, A9, A10	Adjust for maximum deflection with VTVM set to 5 volt scale. Attenuate generator as necessary.
6.	"	"	"	"	DC probe to point ⟨D⟩. Common to chassis.	A11	Adjust for zero reading. A positive and negative reading will be obtained on either side of the correct setting.

SOUND IF ALIGNMENT USING FM SIGNAL GENERATOR AND OSCILLOSCOPE

Use frequency modulated signal with 60∿ modulation and 450KC sweep. Use 120∿ sawtooth voltage in scope for horizontal deflection.
Set contrast control at maximum contrast position.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
5.	.005MFD	High side to point ⟨A⟩. Low side to chassis.	4.5MC (450KC Swp.)	4.5MC	Any non-interfering channel	Vert. Amp. to point ⟨C⟩. Low side to chassis.	A8, A9, A10	Disconnect stabilizer capacitor (C5). Adjust for curve of maximum amplitude and symmetry as in Fig. 4.
6.	"	"	"	"	"	Vert. Amp. to point ⟨D⟩. Low side to chassis.	A11	Reconnect C5. Adjust so that 4.5MC occurs at center of crossover lines as in Fig. 5. SLIGHTLY retouch A10 for maximum amplitude and straightness of crossover lines.

4.5MC TRAP ALIGNMENT

Set contrast control at maximum contrast position.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	CHANNEL	CONNECT VTVM	ADJUST	REMARKS
7.	.005MFD	High side to point ⟨A⟩. Low side to chassis.	4.5MC (Unmod.)	Any non-interfering channel	DC probe thru detector (Fig. 6) to pin 11 (cathode) of picture tube. Low side to chassis.	A12	Adjust for MINIMUM deflection on VTVM.

ALTERNATE 4.5MC TRAP ALIGNMENT

Tune in a local TV station. Adjust the fine tuning control until a noticeable 4.5MC beat appears in the picture. Adjust A12 for minimum 4.5MC beat in the picture. Adjust A12 so that core is approximately centered between the points where the 4.5MC beat appeared in the picture.

VHF RF AND MIXER ALIGNMENT

Adjust the oscilloscope for a 2 inch deflection with 1.5 volt peak to peak signal.
If sweep generator has no built-in marker, loosely couple a separate marker generator to the antenna terminals.
Adjustments A17, A18, A19 and A21 thru A32 are adjusted by expanding or compressing coil turns.
Connect the synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.
The sweep generator output lead should be terminated with its characteristic impedance, usually 50Ω.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
8.	Two 120Ω Carbon Resistors	Across antenna terminals with 120Ω in each lead.	213MC (10MC Swp.)	211.25MC 215.75MC	13	Vert. Amp. thru 47KΩ to point ⟨B⟩. Low side to chassis.	A13, A14	Preset adjustments A15 and A16 at mid-capacity. Preset adjustment A40 for maximum inductance (core fully clockwise). Preset A20 for MINIMUM inductance (core fully counter clockwise). Adjust A13 and A14 for maximum amplitude and response similar to Fig. 7.
9.	"	"	177MC (10MC Swp.)	175.25MC 179.75MC	7	"	A15, A16	Adjust for maximum amplitude, correct tilt, and correct marker position as in Fig. 7.

ALIGNMEN

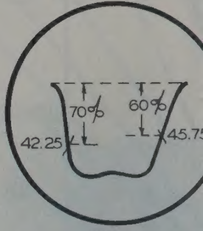


FIG. 1

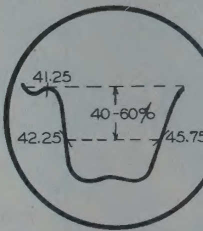
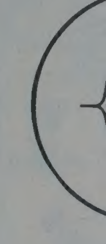
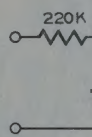
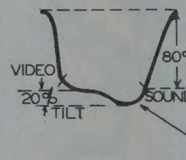


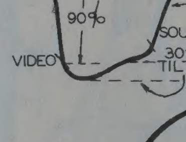
FIG. 3

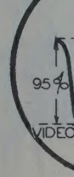




FI







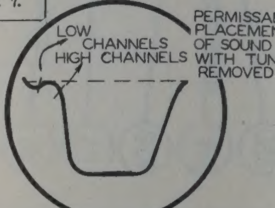


FIG. 9

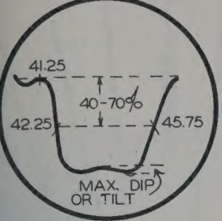


FIG.2

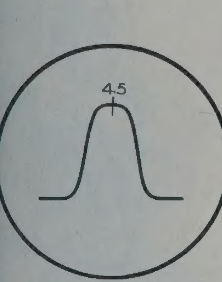
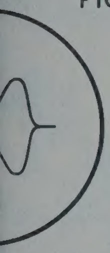


FIG.4



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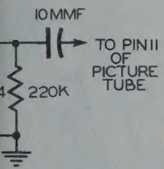


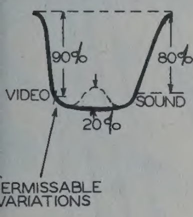
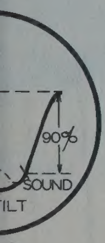


FIG.7



8

ERS
ELD

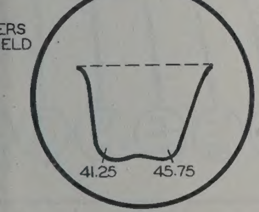


FIG.10

VHF RF AND MIXER ALIGNMENT (Cont.)

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
10.	Two 120Ω carbon resistors	Across antenna terminals with 120Ω in each lead.	207MC (10MC Swp.)		12	Vert. Amp. thru 47KΩ to point ⟨B⟩. Low side to chassis.		Check for response curve on each channel. If response is not within limits on each channel, repeat steps 8 and 9. If necessary, make compromise adjustments of A13 thru A16.
			201MC (10MC Swp.)		11			
			195MC (10MC Swp.)		10			
			189MC (10MC Swp.)		9			
			183MC (10MC Swp.)		8			
11.	"	"	85MC (10MC Swp.)	83. 25MC 87. 75MC	6	"	A17, A18, A19	Adjust A17, A18 and A19 in this order for response curve similar to Fig. 8. Adjust A17 and A18 for correct marker position. Adjust A19 for maximum gain and MINIMUM tilt.
12.	"	"	"	87. 75MC	6	"	A20	Adjust A20 until response curve is just effected at sound marker point.
13.	"	"	79MC (10MC Swp.)	77. 25MC 81. 75MC	5	"	A21, A22, A23	Adjust for response curve similar to Fig. 8. Adjust A21 and A22 for correct marker positions and A23 for maximum gain and MINIMUM tilt.
14.	"	"	69MC (10MC Swp.)	67. 25MC 71. 75MC	4	"	A24, A25 A26	Adjust for response curve similar to Fig. 8. Adjust A24 and A25 for correct marker positions and A26 for maximum gain and MINIMUM tilt.
15.	"	"	63MC (10MC Swp.)	61. 25MC 65. 75MC	3	"	A27, A28, A29	Adjust for response curve similar to Fig. 8. Adjust A27 and A28 for correct marker positions and A29 for maximum gain and MINIMUM tilt.
16.	"	"	57MC (10MC Swp.)	55. 25MC 59. 75MC	2	"	A30, A31, A32	Adjust for response curve similar to Fig. 8. Adjust A30 and A31 for correct marker positions and A32 for maximum gain and MINIMUM tilt.

VHF OSCILLATOR ALIGNMENT

Replace the 6 volt bias as under "Video IF Alignment". Use only enough sweep generator output from generator to produce useable pattern on scope.
Connect the synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.
The sweep generator output lead should be terminated with its characteristic impedance, usually 50Ω.
Set the fine tuning control to the mid-position of its range.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
17.	Two 120Ω Carbon Resistors	Across antenna terminals with 120Ω in each lead.	207MC (10MC Swp.)	209. 75MC	12	Vert. Amp. thru 47KΩ to point ⟨A⟩. Low side to chassis.	A33	Preset adjustment A34 at mid-capacity. Adjust A33 to place sound marker in sound trap as in Fig. 9.
18.	"	"	213MC (10MC Swp.)	215. 75MC	13	"	A34	Check channels 7 thru 13 noting if sound marker for each channel falls just above the trap notch. If more than a 30 degree rotation of fine tuning control is necessary to place sound marker in proper position on any high band, set sweep and marker generator for channel 7 frequency and adjust A34 to place sound marker in trap notch as in Fig. 9.
			207MC (10MC Swp.)	209. 75MC	12			
			201MC (10MC Swp.)	203. 75MC	11			
			195MC (10MC Swp.)	197. 75MC	10			
			189MC (10MC Swp.)	191. 75MC	9			
			183MC (10MC Swp.)	185. 75MC	8			
			177MC (10MC Swp.)	179. 75MC	7			
19.	"	"	213MC (10MC Swp.)	215. 75MC	13	"	A33	Check for correct sound marker position as in Fig. 9. If necessary, readjust A33 to place sound marker in trap notch.
20.	"	"	85MC (10MC Swp.)	87. 75MC	6	"	A35	Adjust to place sound marker in sound trap as in Fig. 9. A35 thru A39 are adjusted by expanding or compressing coil turns.
			79MC (10MC Swp.)	81. 75MC	5		A36	
			69MC (10MC Swp.)	71. 75MC	4		A37	
			63MC (10MC Swp.)	65. 75MC	3		A38	
			57MC (10MC Swp.)	59. 75MC	2		A39	

45. 0MC TRAP ALIGNMENT

Connect the synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
21.	Two 120Ω Carbon Resistors	Across antenna terminals with 120Ω in each lead.	45MC (10MC Swp.)	45MC	2	Vert. Amp. thru 47KΩ to point ⟨A⟩. Low side to chassis.	A40	Increase sweep generator output to produce visible marker on scope. Adjust A40 for MINIMUM response at 45MC.

UHF ALIGNMENT

Connect the synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
22.	Direct	High side to point ⟨E⟩. Low side to chassis.	44MC (10MC Swp.)	41. 25MC 45. 75MC	UHF	Vert. Amp. to point ⟨B⟩. Low side to chassis.	A41, A42, A43	Adjust A41, A42, and A43 for response similar to Fig. 10. Adjust A41 and A42 for correct marker position and A43 for maximum gain and MINIMUM tilt. A41 and A42 are adjusted by expanding or compressing coil turns.

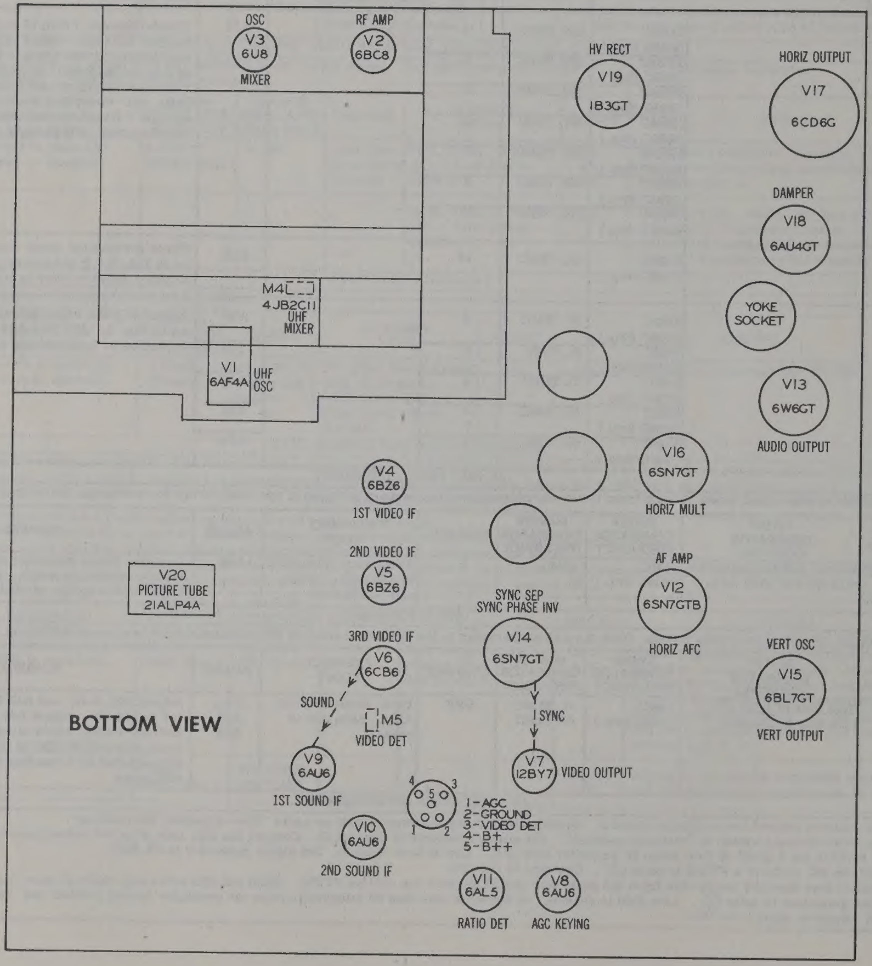
IF SENSITIVITY MEASUREMENT

Set the contrast control for minimum contrast. Disable the horizontal sweep circuit as under "Pre-alignment Instructions".
Set the local-distance switch to "distance-position". Set channel selector to channel 13. Connect the high side of an AM signal generator thru a .001 MFD to pin 1 (grid) of first video IF amplifier tube (V4). Low side to chassis. Set signal generator to 45. 0MC.
Connect the DC probe of a VTVM to point ⟨A⟩. Common to chassis.
A signal of less than 400 microvolts from the generator should produce one volt on VTVM. Short out R30 with a clip lead and move high side of signal generator to point ⟨B⟩. Low side to chassis. A signal of less than 60 microvolts from the generator should produce one volt on VTVM. Remove short from R30.

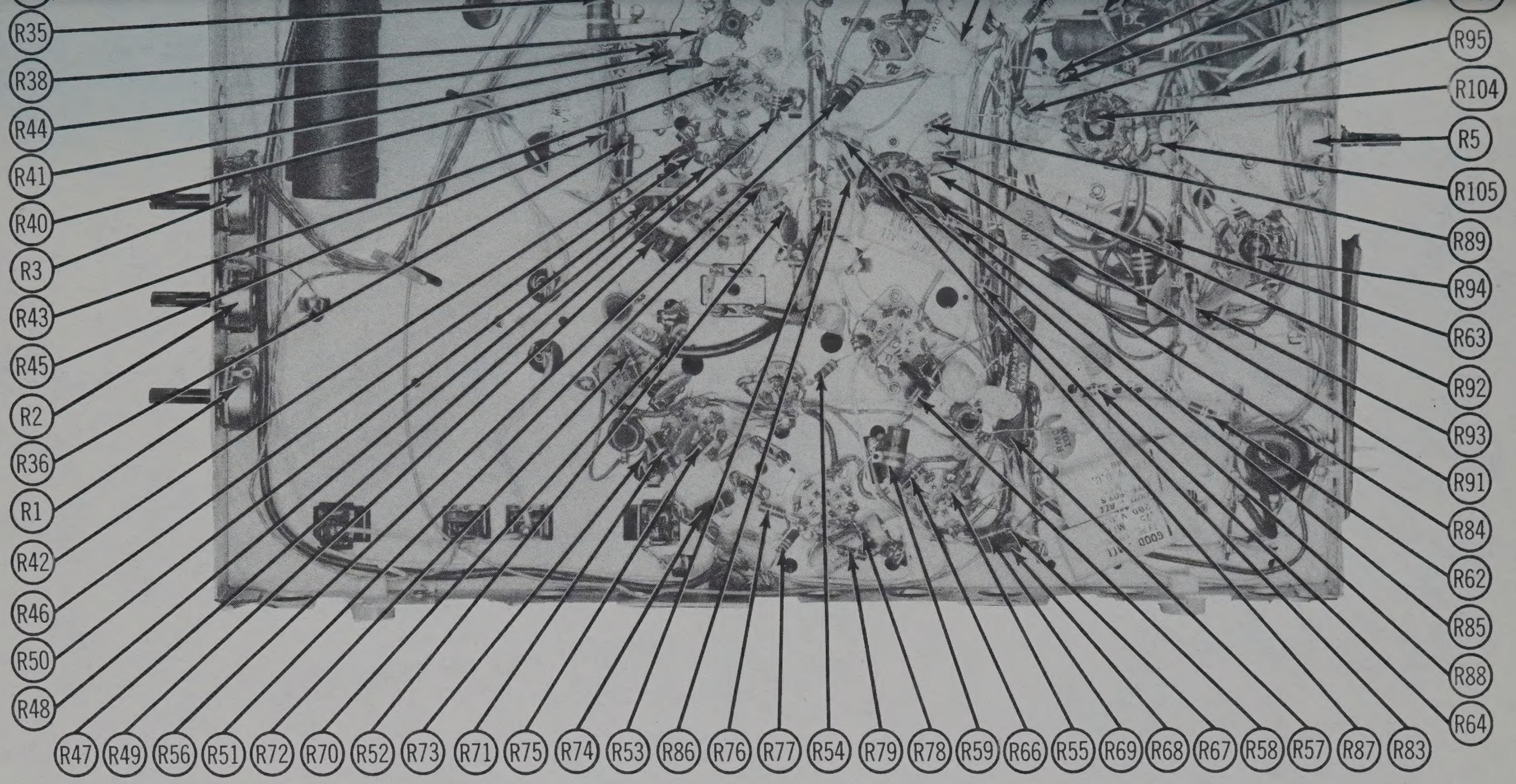
RESISTANCE MEASUREMENTS

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V 1	6AF4A	*■ 2. 7KΩ	20KΩ	. 1Ω	0Ω	0Ω	20KΩ	*■ 2. 7KΩ		
V 2	6BC8	INF	2. 5Meg	0Ω	0Ω	. 1Ω	† 2. 5KΩ	INF	INF	0Ω
V 3	6U8	■ 4. 8KΩ	15KΩ	■ 220KΩ	. 1Ω	0Ω	■ 1KΩ	0Ω	0Ω	15KΩ
V 4	6BZ6	330KΩ	47Ω	0Ω	.1Ω	▲ 220Ω	▲ 220Ω	0Ω		
V 5	6BZ6	85KΩ	▲ 18Ω	0Ω	. 1Ω	† 300Ω	† 300Ω	INF		
V 6	6CB6	1. 2KΩ	120Ω	. 1Ω	0Ω	† 8. 2KΩ	† 40KΩ	0Ω		
V 7	12BY7	45Ω	3. 9KΩ	45Ω	0Ω	0Ω	. 1Ω	■ 5KΩ	■ 470Ω	45Ω
V 8	6AU6	■ 220KΩ	60KΩ	. 1Ω	0Ω	2Meg	† 52Ω	60KΩ		
V 9	6AU6	2. 4Ω	0Ω	. 1Ω	0Ω	■ 10KΩ	■ 10KΩ	150Ω		
V 10	6AU6	15KΩ	0Ω	. 1Ω	0Ω	■ 10KΩ	■ 10KΩ	150Ω		
V 11	6AL5	INF	INF	. 1Ω	0Ω	6. 8KΩ	0Ω	6. 8KΩ		
V 12	6SN7GTB	300KΩ	† 33KΩ	1. 5KΩ	320KΩ	22KΩ	120KΩ	. 4Ω	. 1Ω	
V 13	6W6GT	NC	0Ω	† 255Ω	† 52Ω	† 33KΩ	NC	. 1Ω	60KΩ	
V 14	6SN7GT	1. 8Meg	■ 1Meg	45Ω	22KΩ	■ 9. 5KΩ	2. 2KΩ	. 1Ω	0Ω	
V 15	6BL7GT	◓ 3. 5Meg	◓ 900Ω	7KΩ	550KΩ	◓ 3. 5Meg	50Ω	. 1Ω	0Ω	
V 16	6SN7GT	120KΩ	† 70KΩ	1KΩ	5Meg	† 11KΩ	1KΩ	. 1Ω	0Ω	
V 17	6CD6G	TP	. 1Ω	0Ω	TP	1Meg	TP	0Ω	■ 1KΩ	TOP CAP ◓ 31Ω
V 18	6AU4GT	NC	TP	200KΩ	NC	†55Ω	TP	0Ω	. 1Ω	
V 19	1B3GT		PINS	1-8	HAVE	INF	RESISTANCE			TOP CAP ◓ 196Ω
V 20	21ALP4A	0Ω	■ 3. 5Meg	PIN 6 ◓ 18Ω	PIN 10 ◓ 18Ω	PIN 11 ■110KΩ	PIN 12 . 1Ω			

* MEASURED IN "UHF" POSITION.
■ MEASURED FROM 145V LINE.
▲ MEASURED FROM PIN 7 OF V5.
◓ MEASURED FROM PIN 3 OF V18.
TP-TIE POINT.
NC-NO CONNECTION.


OSC
V3
6U8
MIXER
RF AMP
V2
6BC8
HV RECT
V19
1B3GT
HORIZ OUTPUT
V17
6CD6G
DAMPER
V18
6AU4GT
YOKE SOCKET
M4
4JB2C11
UHF
MIXER
V1
6AF4A
UHF
OSC
V13
6W6GT
AUDIO OUTPUT
V4
6BZ6
1ST VIDEO IF
V16
6SN7GT
HORIZ MULT
2ND VIDEO IF
V5
6BZ6
AF AMP
V12
6SN7GTB
HORIZ AFC
V20
PICTURE TUBE
21ALP4A
SYNC SEP
SYNC PHASE INV
V14
6SN7GT
3RD VIDEO IF
V6
6CB6
VERT OSC
V15
6BL7GT
VERT OUTPUT
BOTTOM VIEW
SOUND
M5
VIDEO DET
SYNC
V7
12BY7
VIDEO OUTPUT
V9
6AU6
1ST SOUND IF
4
5
3
1
2
1-AGC
2-GROUND
3-VIDEO DET
4-B+
5-B++
V10
6AU6
2ND SOUND IF
V11
6AL5
RATIO DET
V8
6AU6
AGC KEYING

TUBE PLACEMENT CHART


R35
R38
R44
R41
R40
R3
R43
R45
R2
R36
R1
R42
R46
R50
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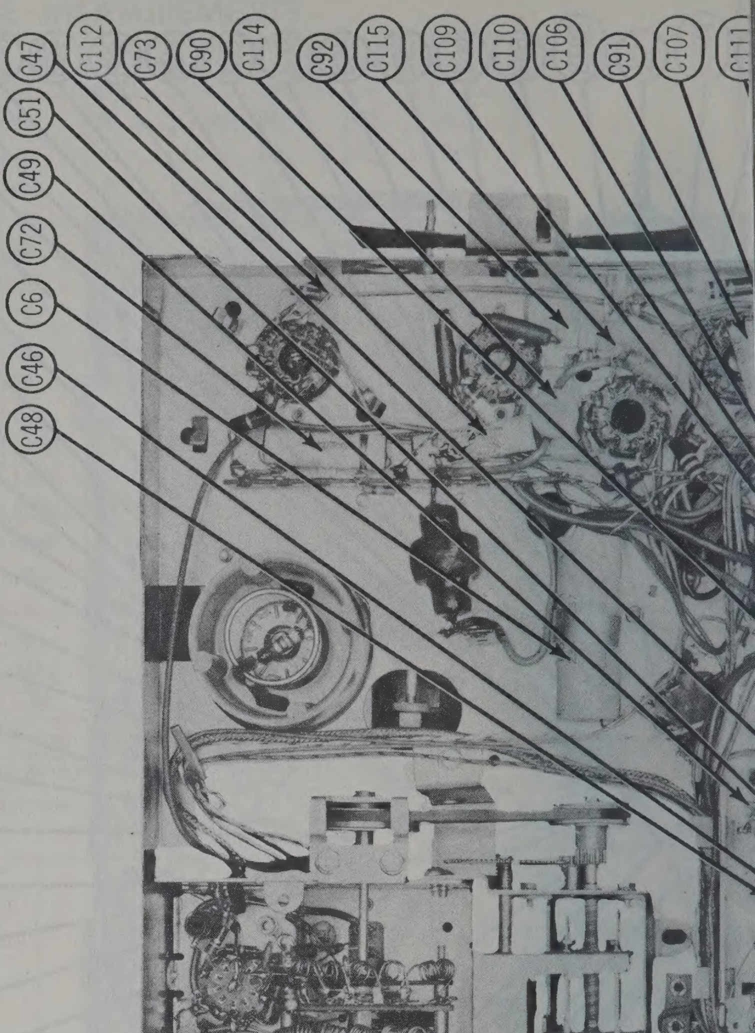
R49
R56
R51
R72
R70
R52
R73
R71
R75
R74
R53
R86
R76
R77
R54
R79
R78
R59
R66
R55
R69
R68
R67
R58
R57
R87
R83
R64
R88
R85
R62
R84
R91
R93
R92
R63
R94
R89
R105
R5
R104
R95

CHASSIS BOTTOM VIEW-RESISTOR IDENTIFICATION

MOTOROLA MODELS Y21K37B, BA, BR, BRA, Y21K39, B, Y21K40, B, Y21T26B, BA, BR,
BRA, CH, CHA, Y21T27B, MA, PK, Y21T28, B, 21K37B, BA, BR, BRA, 21K39, B, 21K40,
B, 21T26B, BA, BR, BRA, CH, CHA, 21T27B, MA, PK, 21T28, B (Ch. TS-534, Y, YB)


C47
C112
C73
C90
C114
C92
C115
C109
C110
C106
C91
C107
C111
C51
C49
C72
C6
C46
C48

Sapphire VIII stereo tape player
with
all-transistor radio

MANUAL 68P43101A13

VOLKSWAGEN
A7MV SERIES

MOTOROLA service manual

GENERAL INFORMATION

These 12 volt models are designed for custom installation in the following vehicles:

Model A7MVF - Volkswagen Fastback

Model A7MVG - Karmann-Ghia

Model A7MVS - Volkswagen Squareback

Model A7MVT - Volkswagen Transporter

Model A7MVW - Volkswagen Sedan

SERVICE STATION PROCEDURE

1. A defective in-guarantee tape/radio unit must be accompanied by the Customer's Guarantee Policy Tag. This tag must be properly filled in by the Volkswagen dealer at the time of the unit purchase. Accept as guarantee repairs only those units within the 1 year or 12,000 miles (whichever occurs first) guarantee period. The removal or re-installation of this unit is customarily performed by the Volkswagen dealer and is not covered by this guarantee. Also, the removal of motor noise, tire static, electrical interference, faulty installations and aerial repairs are not considered as guarantee repairs and, therefore, expenses related to such services should be handled by the car dealer.

2. Fill in Motorola Guarantee Labor Claim, Part Number 68P60016A30, and mail Green and Pink copies to:

Motorola Guarantee Service
Motorola Automotive Products, Inc.
9401 West Grand Avenue
Franklin Park, Illinois.

3. The yellow copy of the Motorola Guarantee Labor Claim is to be retained by the authorized service station for his files.

4. Defective parts for guarantee repairs made on this model are to be sent to your Motorola Distributor for free replacement supported with the defective parts return tag which you are now using.

5. Only those service shops authorized by their Motorola Distributor can perform guarantee repairs on a no-charge basis to the customer. If you are not already authorized as a Motorola Service Station and you are interested in handling this service, please contact your Motorola Distributor for complete details.

OPERATING INSTRUCTIONS

OPERATION

TO PLAY TAPES - Turn unit on by rotating the on-off and volume control to the right. Select a tape cartridge and insert it - label side up and open end first - into the tape slot. Push the cartridge in until it is firmly seated. (THIS IS IMPORTANT.) The tape cartridge will now play, in succession, all four channels. Adjust volume, tone and balance as required.

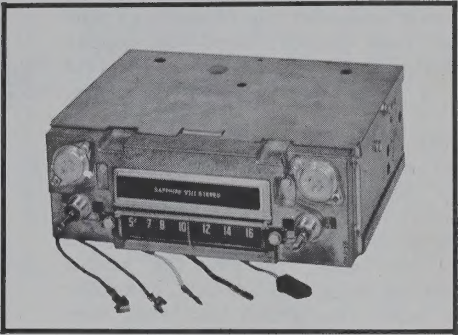
NOTE: Inserting tape cartridge into slot automatically switches this unit from AM radio operation to tape operation.

TO OPERATE AM RADIO - Tape cartridge must be pulled out completely or at least 1" from its seated position before radio will operate. Turn unit on by rotating the on-off and volume control to the right. Tune in desired station with the smaller knob located to the right of the tape slot. Adjust volume, tone and balance as required.

NOTE: When the tape cartridge is removed from the tape slot, the unit automatically switches from tape operation to AM radio operation.

CAUTION: The tape cartridge should always be pulled out completely or approximately 1" from the seated (play) position before leaving car or turning unit off.

TAPE CARTRIDGE CARE



To assure maximum life and noise free operation, tapes should be stored in a cool, clean and dry place, out of the rays of the sun and with the open (tape) end down.

SERVICE NOTES

GENERAL SERVICE NOTES

1. POLARITY - WHEN SERVICING THIS UNIT, THE "A" LEAD MUST BE CONNECTED TO THE POSITIVE SIDE OF POWER SOURCE. IF CONNECTED OTHERWISE, RECEIVER WILL NOT OPERATE AND DAMAGE TO COMPONENTS MAY RESULT.

2. POWER SUPPLY REQUIREMENTS - It is preferable to use a storage battery (without a battery charger) in place of a battery eliminator. If a battery eliminator is used, it must be well filtered and regulated.

3. OUTPUT LOAD - Always operate this receiver with an output load across each of the two channels; either 8 ohm speakers or 8 ohm, 5 watt resistive loads can be used.

4. TRANSISTOR REPLACEMENT - When replacing a transistor other than a power or regulator transistor, grasp the transistor leads between transistor body and plated chassis board with a pair of long nose pliers to prevent excessive heating of transistor body during soldering operation.

5. POWER AND REGULATOR TRANSISTOR REPLACEMENT - When replacing a power or regulator transistor, be sure to:

A. Use the transistor specified in the Replacement Parts List.

MOTOROLA INC. 9401 WEST GRAND AVENUE, FRANKLIN PARK, ILLINOIS
PART NO. 68P43101A13 2-67 PRICE 50 CENTS
COPYRIGHT 1967 BY MOTOROLA INC. - PRINTED IN U.S.A.

B. Coat both sides of transistor insulator with DC-4 grease (Motorola Part No. 11M490487) to insure proper heat dissipation.

C. Securely and evenly tighten the transistor mounting screws.

6. GAINING ACCESS TO THE PLATED BOARDS - Remove top and bottom covers and refer to photo.

Tape Pre-Amp Plated Board - To remove this board for servicing, merely unsolder the chassis ground lead (see photo), bend the copper retaining clip and lift up the chassis to a more serviceable position.

Audio Amplifier Plated Board - To gain access to the bottom side of this board, remove the two (2) screws at the front side of the radio (see photo). To remove the board for servicing, remove the screw from the mounting bracket, unsolder the tabs, straighten the tabs, then remove the mounting bracket.

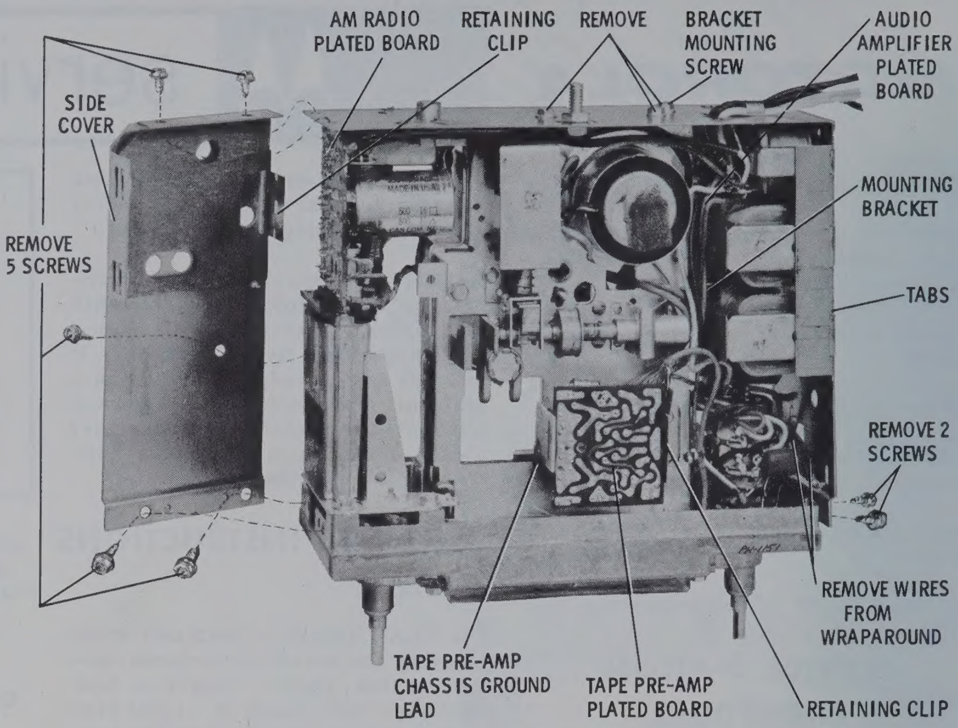
AM Radio Plated Board - To service this board, remove the 5 side cover mounting screws, bend the copper retaining clip so that the side cover can be removed from this board.

7. OUTPUT TRANSFORMER AND FILTER CHOKE REPLACEMENT - Remove 5 screws, 2 at front and 3 at rear (see photo); also remove ground leads from control and pull out wraparound far enough so that transformer or filter choke can be removed.

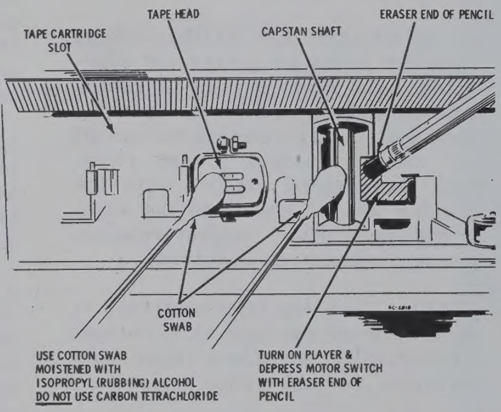
8. TAPE CARTRIDGES - Before servicing the tape player portion of this unit, always check for the possibility of a defective pre-recorded tape cartridge, particularily if one is returned with the unit. This should be done by substituting the tape cartridge with one that is known to be good.

9. TAPE HEAD AND CAPSTAN CLEANING - One major cause of improper tape player operation is oxide build-up on the head and capstan. During normal operation, some iron oxide particles are loosened from the tape and build up. This accumulation of oxide can cause poor playback and up and down tape travel. The head and capstan should be cleaned whenever the unit is serviced and this can be done either in the car or on the service bench. To clean the head and capstan, use a cotton swab moistened with head cleaner or isopropyl alcohol, then wipe dry.

(CAUTION should be exercised when cleaning playback head to prevent getting cleaner on any plastic parts.)


AM RADIO PLATED BOARD
RETAINING CLIP
REMOVE
BRACKET MOUNTING SCREW
AUDIO AMPLIFIER PLATED BOARD
SIDE COVER
MOUNTING BRACKET
REMOVE 5 SCREWS
TABS
REMOVE 2 SCREWS
REMOVE WIRES FROM WRAPAROUND
TAPE PRE-AMP CHASSIS GROUND LEAD
TAPE PRE-AMP PLATED BOARD
RETAINING CLIP

GAINING ACCESS TO PLATED BOARDS, FILTER CHOKE AND OUTPUT TRANSFORMERS


TAPE HEAD
ERASER END OF PENCIL
TAPE CARTRIDGE SLOT
CAPSTAN SHAFT
COTTON SWAB
USE COTTON SWAB MOISTENED WITH ISOPROPYL (RUBBING) ALCOHOL DO NOT USE CARBON TETRACHLORIDE
TURN ON PLAYER & DEPRESS MOTOR SWITCH WITH ERASER END OF PENCIL

TAPE HEAD & CAPSTAN CLEANING

10. HEAD DEMAGNETIZING - Do not use magnetized screwdrivers and wrenches near the head since these can magnetize the head. The head may also, after a long period of time, acquire some residual magnetism. A head that is magnetized will show a definite loss of high frequency response and an increase in noise level. Use a commercially available head demagnetizer, following instructions included with the unit to demagnetize the head.

11. HEAD REPLACEMENT - The location of the tape head with respect to its mounting bracket is very critical; for this reason, replacement heads are supplied already secured to their mounting bracket and positioned correctly at the factory. When replacing a head, remember to replace it as an assembly, that is, remove the defective head and bracket and replace it with the new head and bracket assembly.

If for some reason the location of the head has changed (due to a loose mounting screw, etc.), position it as shown in "Head Positioning Adjustment".

ADJUSTMENTS AND LUBRICATION

ADJUSTMENTS

Head adjustments are normally required for cases of cross-talk, loss or noisy frequency response or if the head has been replaced.

A suitable test tape should be used for the azimuth and height adjustments. Motorola has a suitable test tape cartridge available for the field under Part Number 99P43309A01. Instructions, in the form of a label on the cartridge, are included.

Connect 8 ohm loads (either speakers or resistors) across the output of both channels and set tone control to treble (maximum clockwise). Use an oscilloscope or AC output meter and a 1/16" Allen wrench for azimuth and height adjustments (Motorola Part Number 66P40059A32).

HEIGHT

This is an adjustment to move the tape head up or down so that it can be positioned exactly in line with the pre-recorded information on the tape. Misadjustment of this screw would cause cross-talk and/or poor separation.

With the Motorola test tape, proceed as follows:

1. Remove top cover and make sure output loads are connected across each channel.

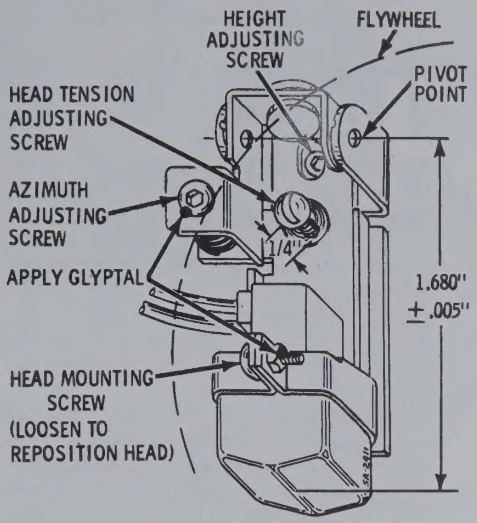
2. Insert test tape cartridge into tape slot and position head to tracks #2 and #6.

3. Set balance control for maximum output from left channel.

4. Connect scope (or VTVM) across left channel output - (track #2 information - 1Kc will be presented). Adjust height adjusting screw for a null. The reason for the null is that the 1Kc information is recorded not on track #2 but on the guard bands adjacent to track #2. This adjustment will minimize cross-talk.

5. Azimuth - Connect scope or VTVM across the output of the right channel and adjust balance control for maximum right channel output - (track #6 information - 8Kc will be presented). Adjust azimuth adjusting screw for maximum output.

Misadjustment of this screw would cause poor high frequency response.



HEAD ADJUSTMENTS

6. Repeat Steps #4 and #5 to optimize these adjustments, then cement adjusting screws in place with glyptal (Motorola Part Number 11P40059A53) or other non-hardening cement.

NOTE: Before cementing, index head 4 times and recheck for null; optimize the adjustment.

The next two adjustments are not normally required except when the head has been replaced or tampered with.

HEAD TENSION ADJUSTMENT

This adjustment will have to be made if the head assembly has been replaced. Adjust the screw so that there is 1/4" between the bottom flat of the screw head and the head mounting bracket with head in its lowest position (tracks #4 and #8). Apply glyptal to the screw from the bottom.

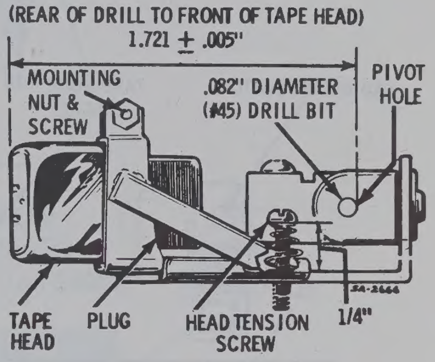
HEAD POSITIONING ADJUSTMENT

Not normally required unless tampering has occurred or if mounting screw has loosened.

The head should be set to 1.680" ± .005" measured from the center of the pivot hole to the front of the head.

Since this dimension is quite critical and may be difficult to gain access to, an alternate method is covered below.

Remove the head and bracket assembly from the tape deck mechanism by first unplugging the cable from the rear of the head, then remove the head tension screw. Loosen the head mounting screw and apply locktite (or other suitable adhesive) to the 4 surfaces of the head where it contacts the bracket. Insert a .082" drill bit (#45 drill) through both pivot holes. With a rule guage or vernier caliper, adjust the head to 1.721" ± .005" measured from the rear edge of the drill to the front edge of the tape head (see detail). Tighten the head mounting screw and apply glyptal to the mounting nut and screw. Re-install the head and bracket assembly, then adjust the head tension screw to the 1/4" dimension referred to in the detail. Again, apply glyptal to the bottom of this screw. Lastly, perform the azimuth and height adjustments on the head as referred to above.



HEAD POSITIONING

LUBRICATION (Refer to exploded view on page 10)

The unit is lubricated at the factory and normally no additional lubrication is required; however, if parts are replaced, the following areas should be lubricated with a lightweight, low temperature grease (Motorola Part No. 11P40059A55).

A. Drive surface of cam (39).

B. Ball bearing on end of cam (40).

C. Solenoid plunger (38).

D. Ball bearings in head mounting bracket (63 and 76).

Silicon grease (Dow Corning DC-4 - Motorola Part Number 11M490487) should be applied to the bottom of the capstan shaft (5).

TAPE PLAYER DRIVE & HEAD POSITIONING

The view shown below is one looking into the tape player from the front with a tape cartridge inserted and operating.

When the tape cartridge is inserted into the tape slot and with the unit turned on, the radio-tape switch switches the input of the audio system from the radio circuitry to tape pre-amp circuitry. At the same time, the front of the tape cartridge activates a micro-switch which, in turn, turns on the tape motor.

The drive belt on the motor shaft drives the flywheel causing it to rotate. The flywheel shaft (capstan) which presses the tape against the rubber pressure roller (inside the cartridge) drives the tape. The tape guide bracket keeps the tape from riding up and down the head.

Since the pre-recorded tape has four dual channel programs (8 tracks), the head has to be moved to four different height positions with respect to the tape. The sequence of head movement is as follows:

Tracks #1 and #5

Tracks #2 and #6

Tracks #3 and #7

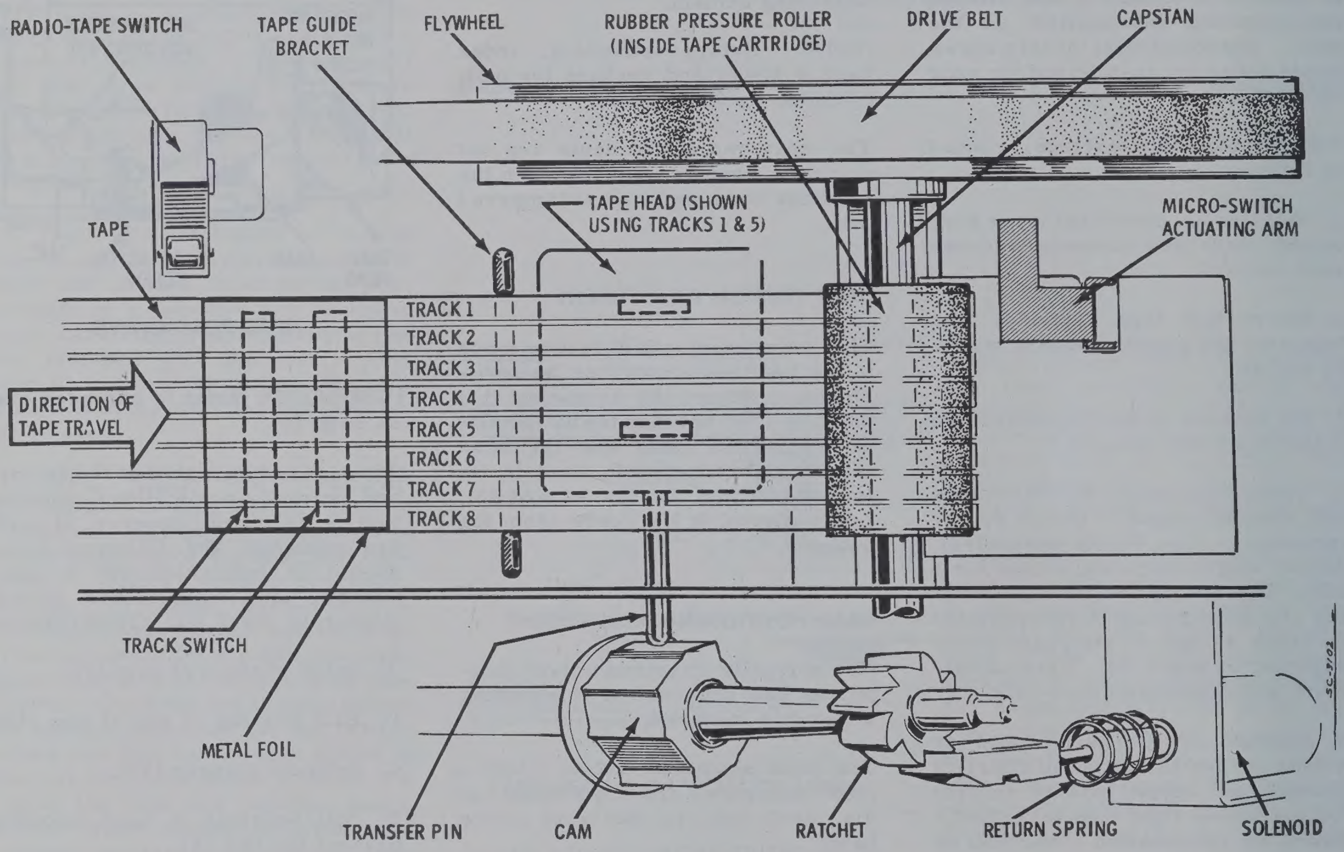
Tracks #4 and #8

Tracks #1 and #5 (return to original tracks)

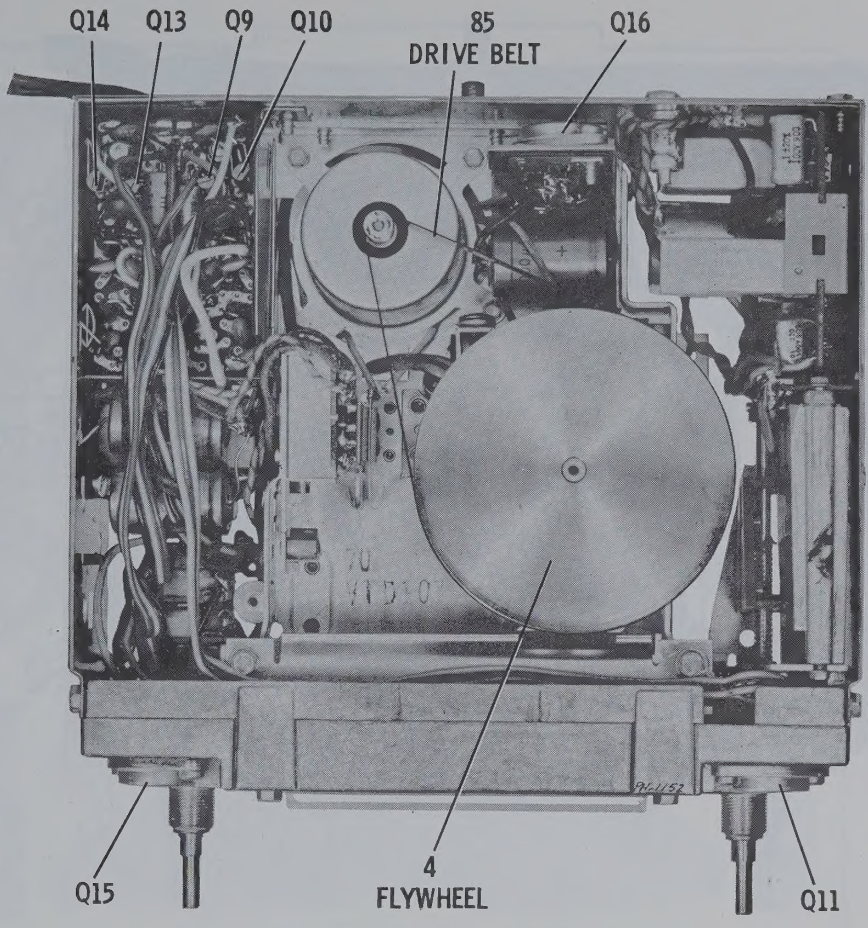
Tracks #1 - #4 are left channel; tracks #5 - #8 are right channel.

The positioning of the head can be accomplished either manually or automatically. Manual positioning is accomplished whenever the channel selector switch (on volume control shaft) is pushed in and released. The momentary shorting of this switch returns one end of the solenoid winding to ground. The resultant magnetic field in the solenoid pulls in the solenoid's spring loaded shaft for an instant; when the shaft returns to its original position, it detents the ratchet end of the cam shaft to its next position. In contact with the irregularly shaped cam is the tape head transfer pin (located beneath the head) which moves the head up or down.

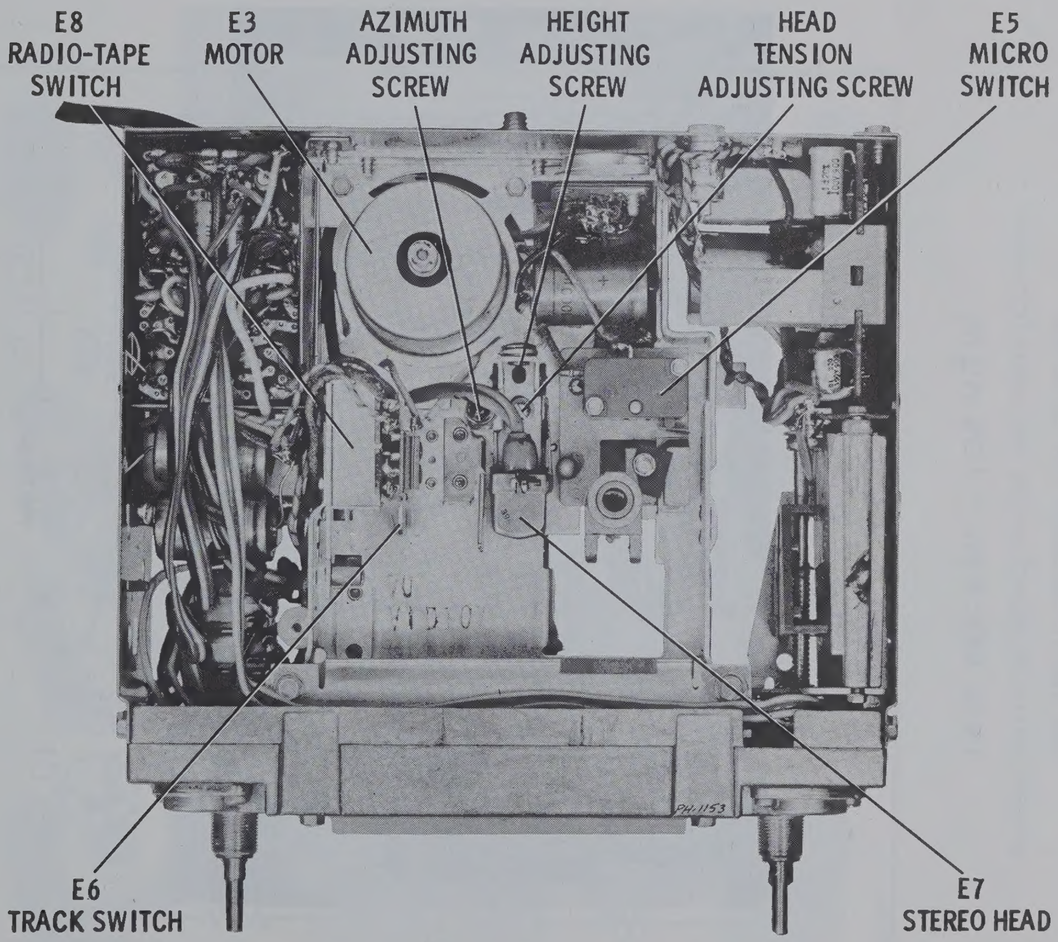
Automatic positioning of the head to the next dual channel program is accomplished by the tape itself when the end of a program is reached. The pre-recorded tape has, at the end of the recorded programs, a strip of metal foil which shorts out the track switch which is in contact with the tape at all times. This switch is wired in parallel with the channel selector switch to start the same action that occurred when the channel selector switch was activated.


RADIO-TAPE SWITCH
TAPE GUIDE BRACKET
FLYWHEEL
RUBBER PRESSURE ROLLER (INSIDE TAPE CARTRIDGE)
DRIVE BELT
CAPSTAN
TAPE HEAD (SHOWN USING TRACKS 1 & 5)
MICRO-SWITCH ACTUATING ARM
TAPE
DIRECTION OF TAPE TRAVEL
TRACK 1
TRACK 2
TRACK 3
TRACK 4
TRACK 5
TRACK 6
TRACK 7
TRACK 8
TRACK SWITCH
METAL FOIL
TRANSFER PIN
CAM
RATCHET
RETURN SPRING
SOLENOID
SC-7102

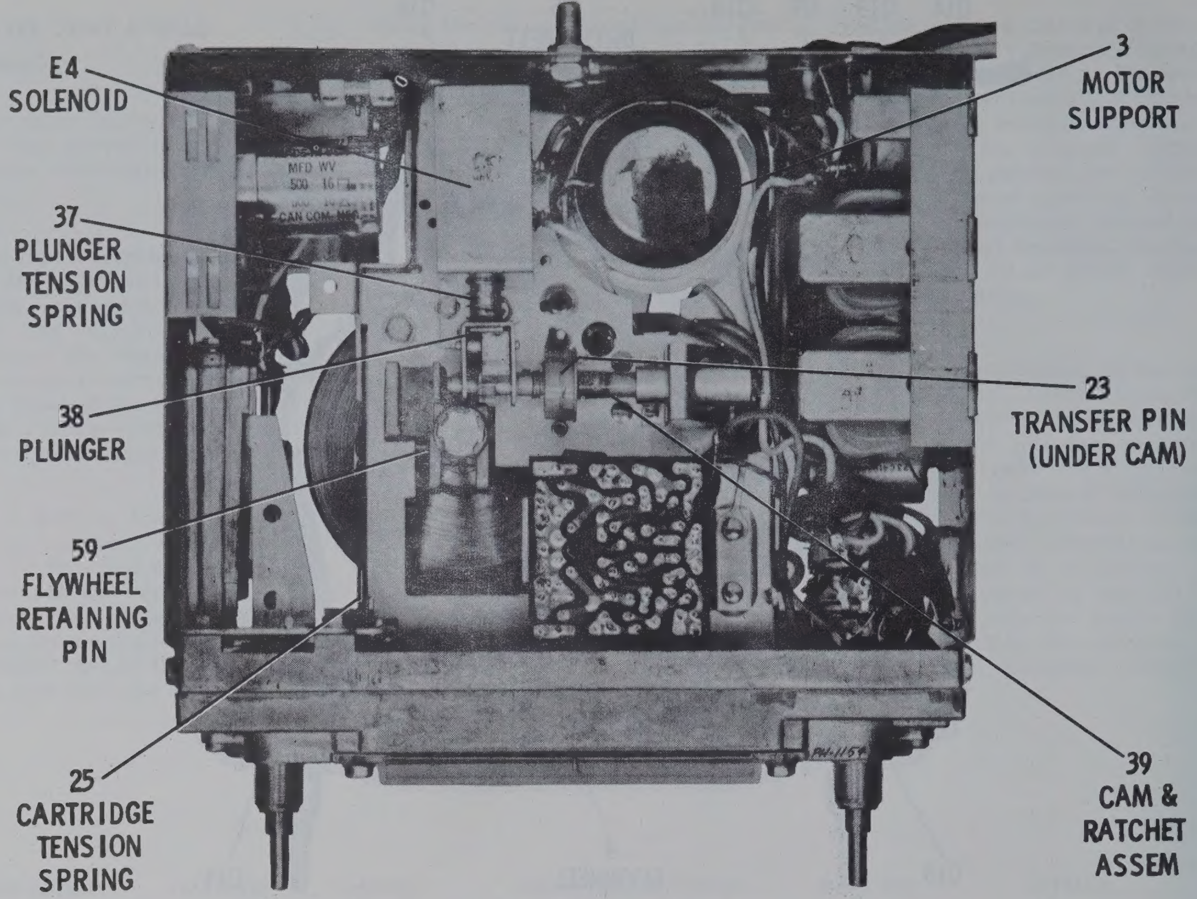
TAPE DRIVE AND HEAD POSITIONING


Q14
Q13
Q9
Q10
85
DRIVE BELT
Q16
PH-1152
Q15
4
FLYWHEEL
Q11

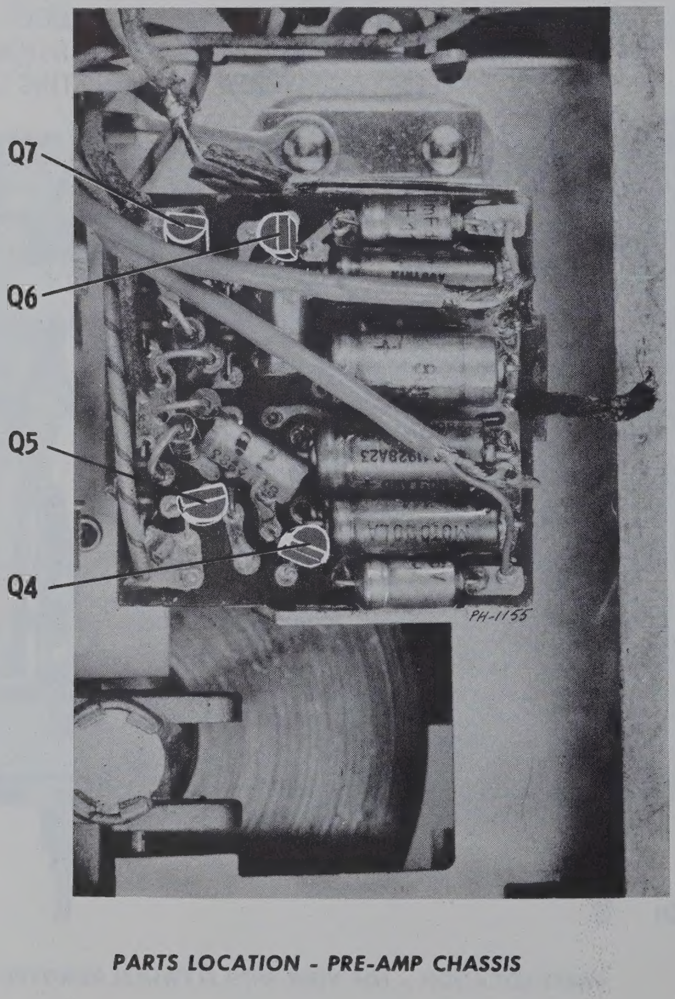
PARTS LOCATION - TOP VIEW


E8
RADIO-TAPE
SWITCH
E3
MOTOR
AZIMUTH
ADJUSTING
SCREW
HEIGHT
ADJUSTING
SCREW
HEAD
TENSION
ADJUSTING SCREW
E5
MICRO
SWITCH
PH-1153
E6
TRACK SWITCH
E7
STEREO HEAD

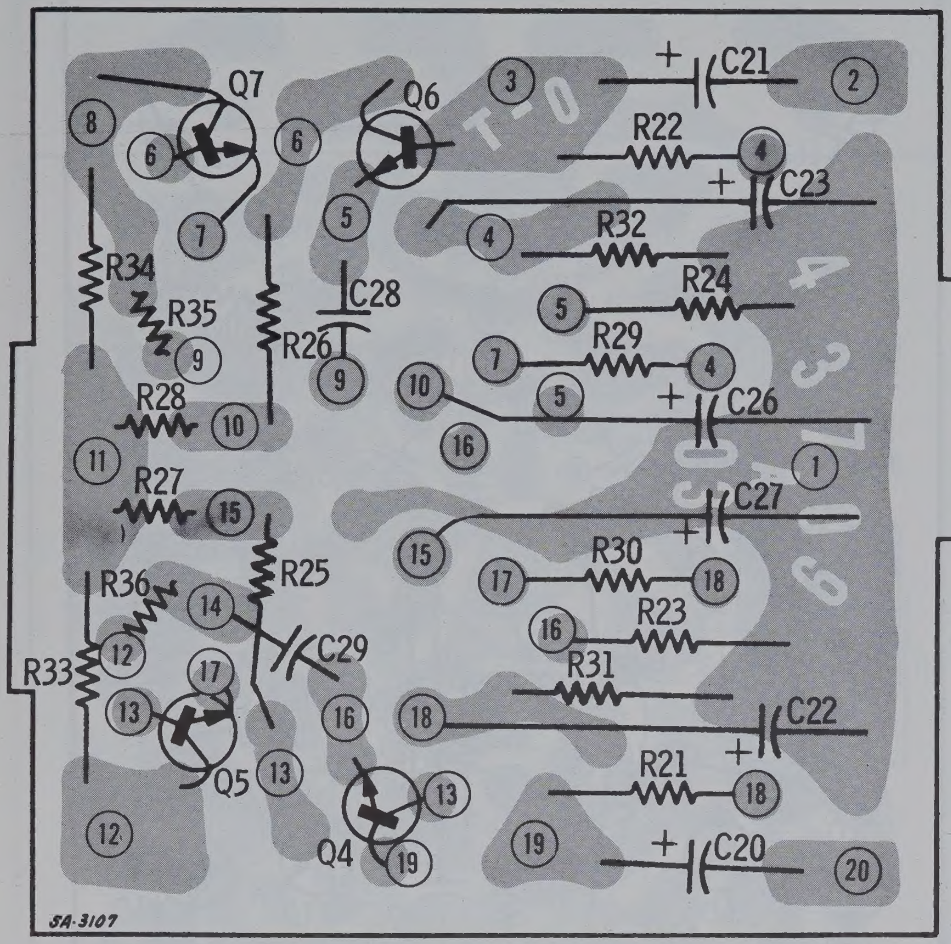
PARTS LOCATION - TOP VIEW WITH FLYWHEEL REMOVED


E4
SOLENOID
37
PLUNGER
TENSION
SPRING
38
PLUNGER
59
FLYWHEEL
RETAINING
PIN
25
CARTRIDGE
TENSION
SPRING
3
MOTOR
SUPPORT
23
TRANSFER PIN
(UNDER CAM)
39
CAM &
RATCHET
ASSEM
PH-1154

PARTS LOCATION - BOTTOM VIEW


Q7
Q6
Q5
Q4
PH-1155

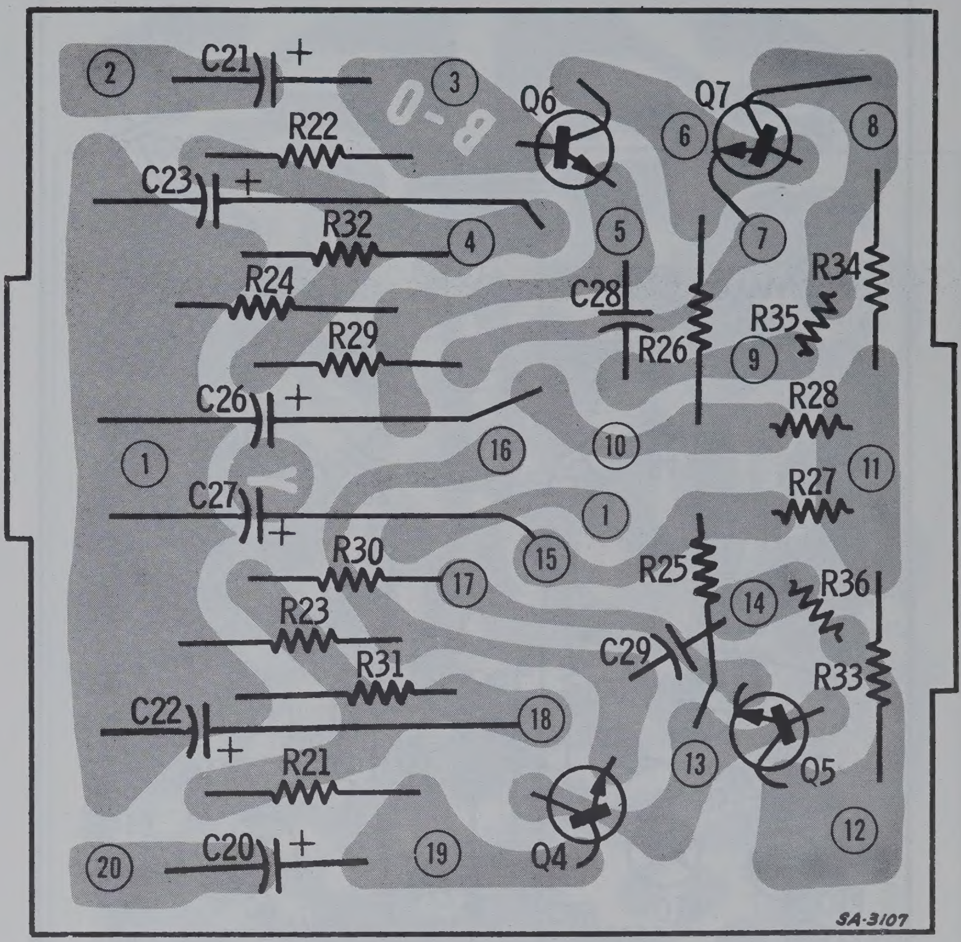
PARTS LOCATION - PRE-AMP CHASSIS


Q7
Q6
Q5
Q4
C21
C23
C28
C26
C27
C29
C22
C20
R22
R32
R24
R29
R30
R23
R31
R21
R34
R35
R26
R28
R27
R25
R36
R33
T-0
4 3 7 0 9
A
05
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
+
SA-3107

TAPE PRE-AMP - TOP VIEW

PLATED CHASSIS REFERENCE POINTS AND PARTS LOCATION

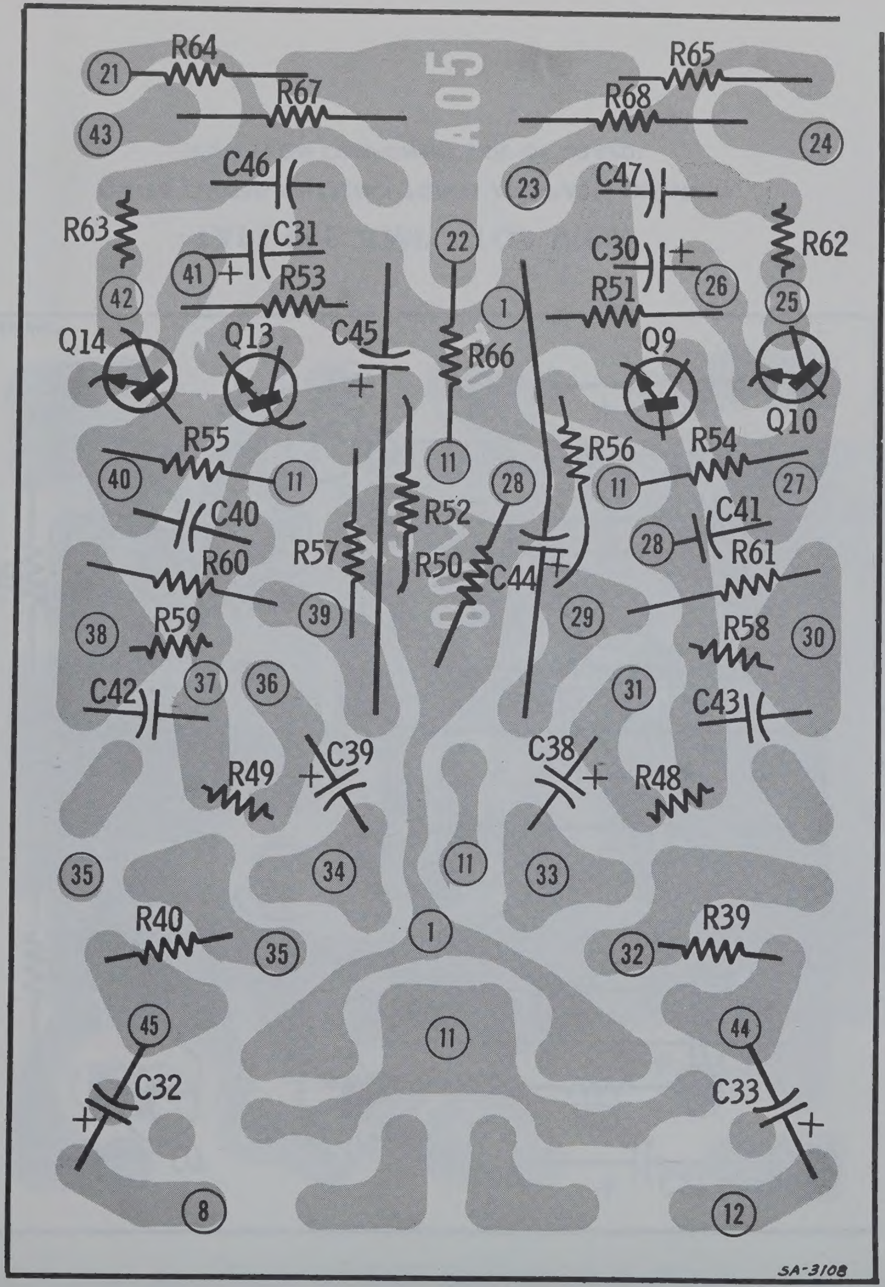
(VIEW FROM COMPONENT SIDE OF BOARD)


C21
C23
C26
C27
C22
C20
C28
C29
R22
R32
R24
R29
R30
R23
R31
R21
R26
R34
R35
R28
R27
R25
R36
R33
Q6
Q7
Q5
Q4
B-0
Y
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
+
SA-3107

TAPE PRE-AMP - BOTTOM VIEW

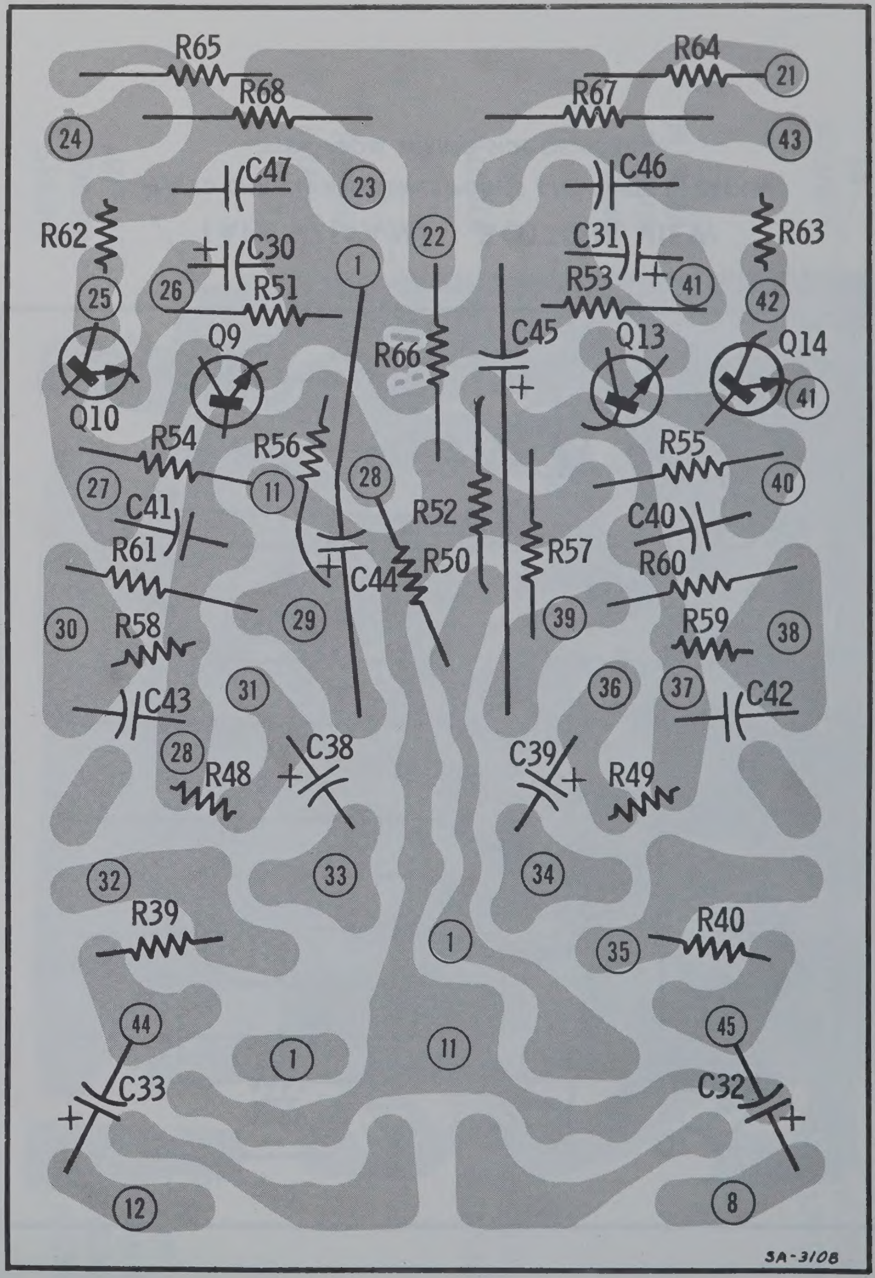
PLATED CHASSIS REFERENCE POINTS AND PARTS LOCATION

(VIEW FROM WIRING SIDE OF BOARD)


R64
R65
R67
R68
A05
C46
C47
R63
R62
C31
C30
R53
R51
C45
R66
Q14
Q13
Q9
Q10
R55
R56
R54
C40
C41
R57
R52
R50
C44
R60
R61
R59
R58
C42
C43
C39
C38
R49
R48
R40
R39
C32
C33
21
43
42
41
40
38
37
36
35
34
45
8
22
23
24
25
26
27
28
29
30
31
32
33
39
11
1
44
12
SA-3108

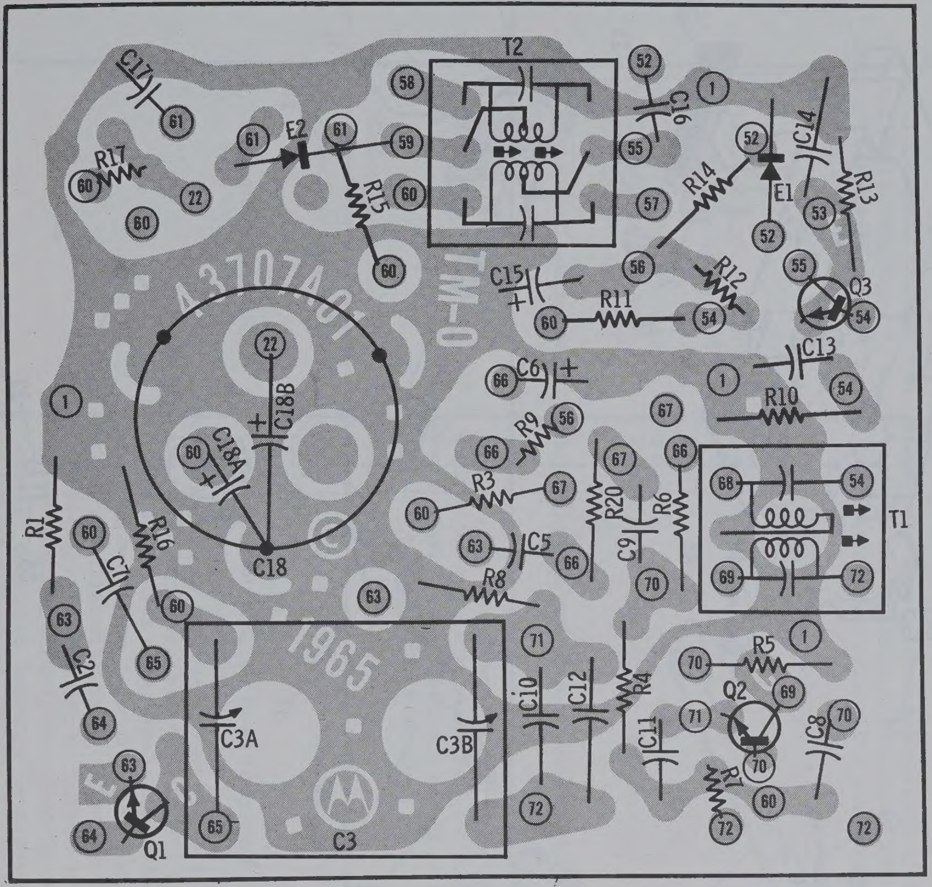
AUDIO AMPLIFIER - TOP VIEW

PLATED CHASSIS REFERENCE POINTS AND PARTS LOCATION
(VIEW FROM COMPONENT SIDE OF BOARD)


R65
R64
R68
R67
C47
C46
R62
R63
C30
C31
R51
R53
R66
C45
Q10
Q9
Q13
Q14
R54
R56
R55
C41
R52
R57
C40
R61
C44
R50
R60
R58
R59
C43
C42
C38
C39
R48
R49
R39
R40
C33
C32
24
23
22
21
43
25
26
1
41
42
27
11
28
40
29
39
30
38
31
36
37
32
33
34
35
44
45
12
8
SA-3108

AUDIO AMPLIFIER - BOTTOM VIEW

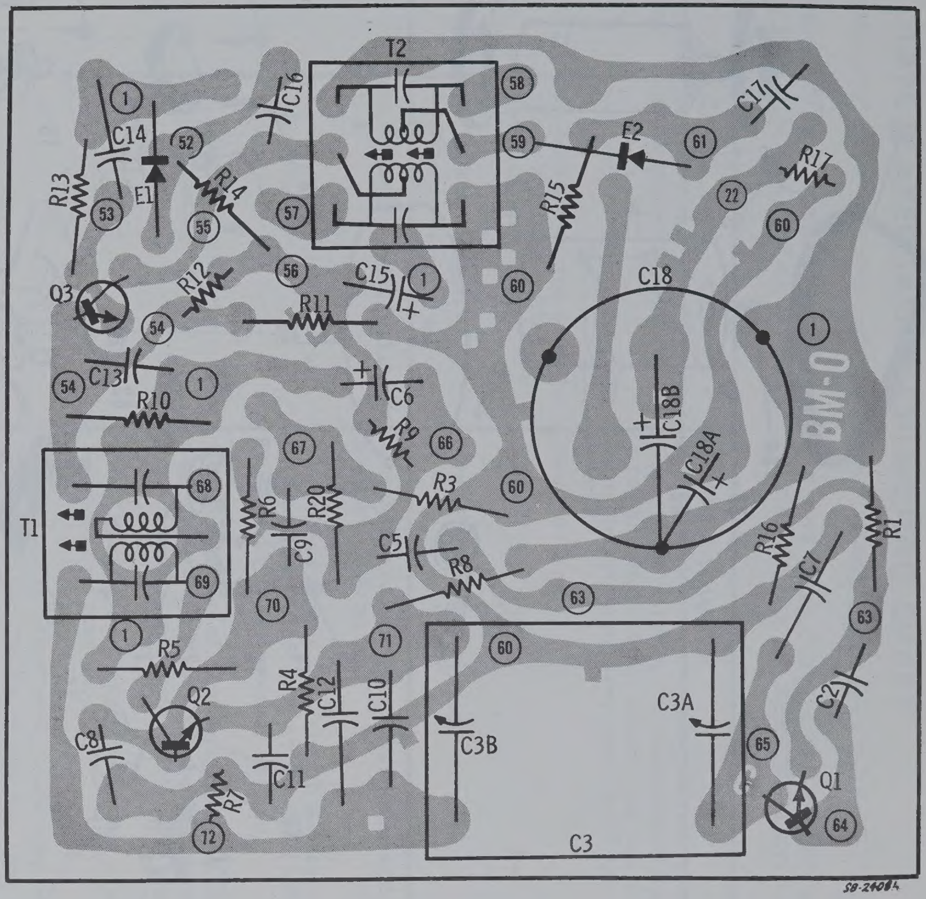
PLATED CHASSIS REFERENCE POINTS AND PARTS LOCATION
(VIEW FROM WIRING SIDE OF BOARD)


T2
C17
E2
R17
R15
C16
R14
E1
C14
R13
C15
R11
R12
Q3
C13
C6
R10
A3707401
TM-0
C18B
C18A
C18
R9
R3
R20
R6
T1
R1
R16
C7
C5
C9
R8
C2
1965
R5
C10
C12
R4
Q2
C3A
C3B
C11
C8
R7
Q1
C3

AM RADIO - TOP VIEW

PLATED CHASSIS REFERENCE POINTS AND PARTS LOCATION

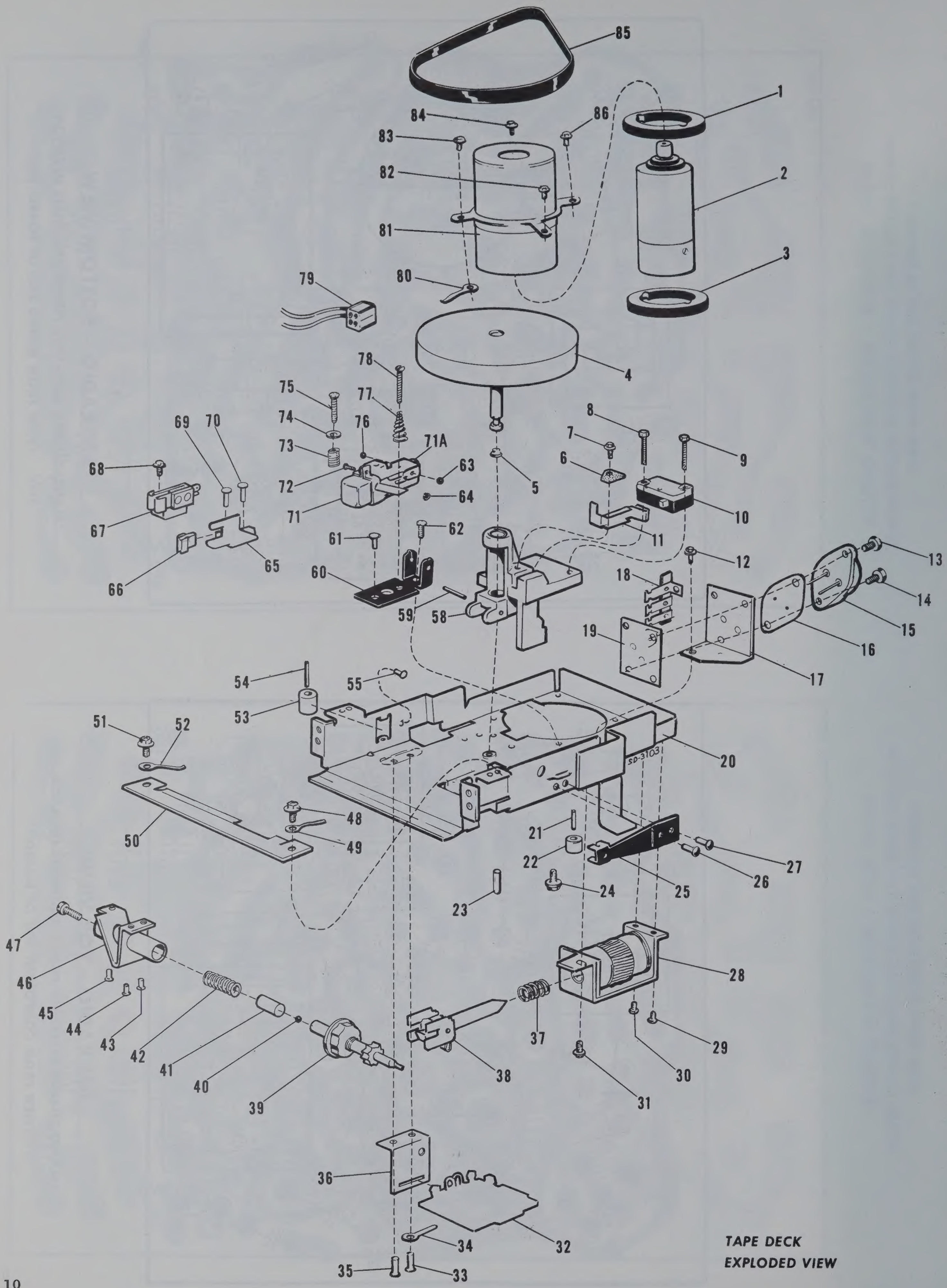
(VIEW FROM COMPONENT SIDE OF BOARD)


T2
C16
C17
C14
E1
R14
E2
R13
R15
R17
Q3
R12
C15
R11
C18
C13
R10
C6
R9
BM-0
C18B
C18A
T1
R6
R20
R3
C9
C5
R8
R16
C7
R1
R5
R4
C12
C10
C3A
C2
C8
Q2
C3B
C11
R7
Q1
C3
S8-2408L

AM RADIO - BOTTOM VIEW

PLATED CHASSIS REFERENCE POINTS AND PARTS LOCATION

(VIEW FROM WIRING SIDE OF BOARD)


85
1
84
86
83
82
2
81
3
79
80
4
78
75
77
74
76
71A
73
63
8
7
9
6
5
68
69
70
72
64
71
10
67
62
61
11
12
13
65
60
18
14
66
59
58
15
19
16
17
54
55
53
51
52
20
SD-3103
48
50
49
21
22
27
26
25
24
23
47
28
46
45
44
37
43
42
41
40
39
38
29
30
31
36
34
32
35
33

TAPE DECK
EXPLODED VIEW

TAPE PLAYER TROUBLESHOOTING CHART

NOTE #1: DO NOT OPERATE TAPE PLAYER UPSIDE DOWN - CARTRIDGE MAY JAM.

NOTE #2: MANY TAPE PLAYER PROBLEMS CAN BE CAUSED BY DEFECTIVE CARTRIDGES; BEFORE SERVICING THE TAPE PLAYER, CHECK FOR A DEFECTIVE CARTRIDGE BY SUBSTITUTING A KNOWN GOOD CARTRIDGE.

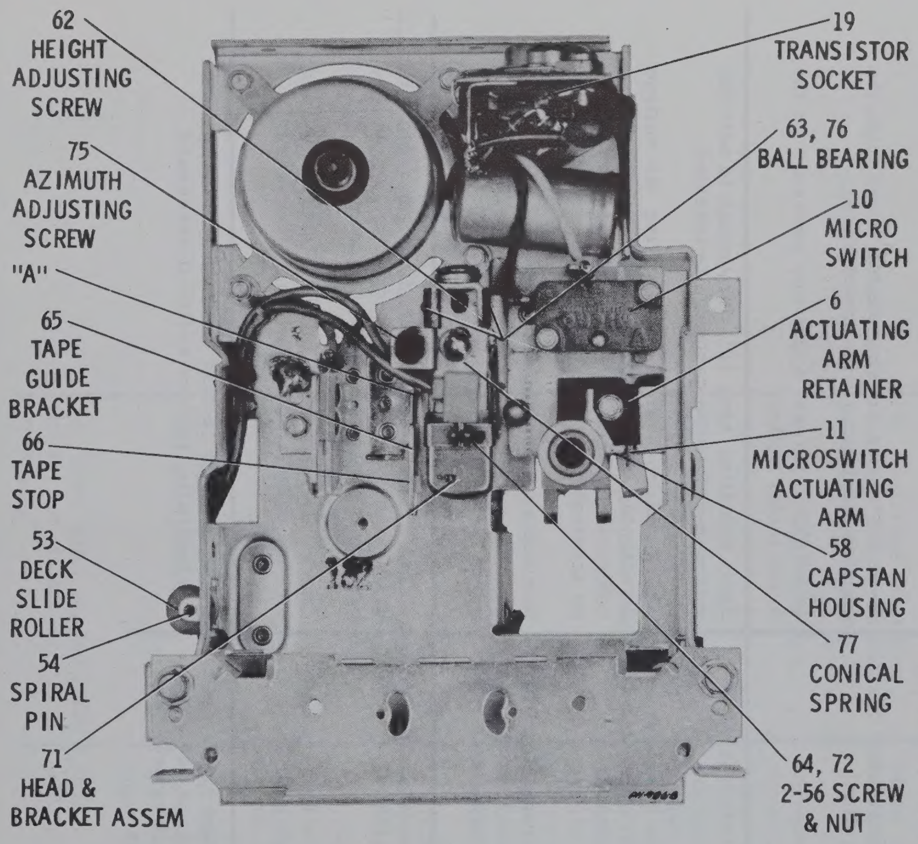
SYMPTOM	**CAUSE**	**POSSIBLE SOLUTION**
Tape breaks or winds up around capstan shaft.	1. Defective tape cartridge.	Check tape cartridge by inserting a known good tape cartridge. Before inserting new cartridge, examine actuating arm (see Cause #2).
	2. Bent or burred edge on front of micro-switch actuating arm (11).	Replace arm.
	3. Defective capstan housing (58).	Replace capstan housing.
Cross-talk.	1. Defective tape cartridge.	Check tape cartridge by substitution with a known good tape cartridge.
	2. Tape head (71) out of adjustment.	Check head height and azimuth adjustments with a test tape (Motorola Part No. 99P43309A01) as outlined in "Adjustments" section.
	3. Head mounting bracket (71A) binding.	Grasp at rear of head mounting bracket with a pair of long nose pliers and squeeze gently while moving head up and down until binding is relieved. CAUTION: Do not apply excessive pressure as ball bearings may pop out. To check this adjustment, index tape head to its lower position (tracks #4 and #8), then with unit vertical, lift up tape head; it should have sufficient tension to spring back against the transfer pin without binding. Also check for 1/4" adjustment of head tension adjusting screw (see "Adjustments").
	4. Tape guide bracket (65) not positioning tape correctly with respect to tape head.	Check distance between bottom edge of tape guide bracket and chassis; it should be .090" - .095". If it is not, bend or replace the tape guide bracket. CAUTION: Bend at point "A" not at the two (2) tines (see photo).
	5. Thrust plate on bottom of capstan housing (58) loose or missing.	Replace capstan housing.
	6. Defective cam and ratchet assembly (39).	Replace cam and ratchet assembly.
	7. Tape head not indexing correctly.	See "Improper or Erratic Head Indexing".
Motor runs fast.	1. Defect in regulator circuitry.	Check regulator transistor by shorting base to emitter of regulator transistor (to remove forward bias), motor should stop; if it does not, regulator transistor is shorted.
	2. Defective motor (2).	Replace.
Slow speed (also see "Poor Tape Drive").	1. Defective tape cartridge.	Check tape cartridge by inserting a known good cartridge.
	2. Mechanical binding.	Check for binding by first removing tape cartridge, turn on motor with micro-switch actuating arm and check flywheel speed with a strobe disc (Motorola Part Number 68P40059A33 or equivalent). If speed is excessively slow, shut off unit and remove drive belt; flywheel should move freely when turned by hand. If it does not, check for missing nylon bearing on bottom of flywheel, loose or missing thrust plate at bottom of capstan housing, defective bearings in capstan housing or defective flywheel.

TAPE PLAYER TROUBLESHOOTING CHART (CON'T)

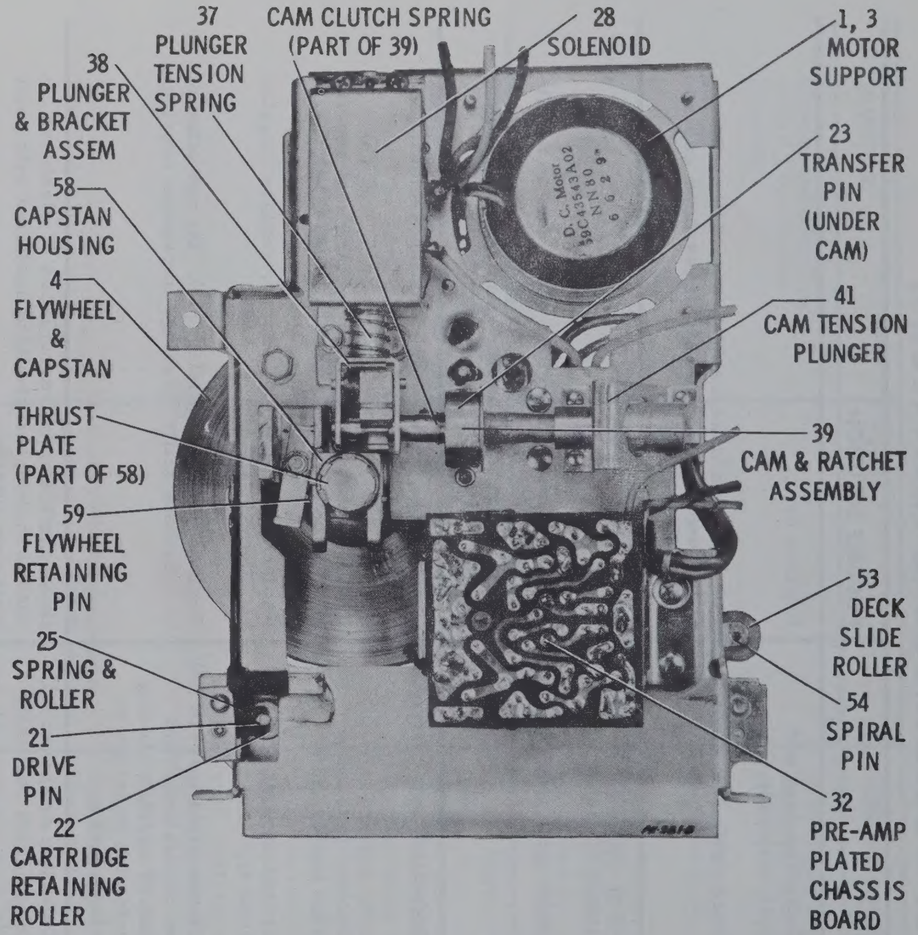
SYMPTOM	CAUSE	POSSIBLE SOLUTION
Slow speed (also see "Poor Tape Drive"). (Cont'd)		If flywheel moves freely when turned by hand, check for defective drive belt, tape cartridge or electrical problem (see Cause #3).
	3. Electrical defects. A. Open regulator filter capacitor, C-52.	Replace C-52.
	B. Defective motor (2).	Check motor by grounding motor governor (junction of yellow motor wire and R-18) for an instant, motor should speed up; if motor does not speed up, motor is defective. If motor does speed up, check voltages in regulator circuitry.
Poor tape drive, wow and flutter (also see "Slow Speed").	1. Defective tape cartridge.	Check tape cartridge by inserting a known good tape.
	2. Insufficient tension on tape cartridge.	Check cartridge tension by pulling cartridge slightly away from tape head, then release; the cartridge should snap back into place and there should be no end play on the right side of the cartridge. If the cartridge does not snap in or there is end play, replace the spring and roller (25). Make sure mounting screw does not protrude too far to interfere with cartridge. Also, with cartridge inserted, the roller (53) on the left side should be in contact with the cartridge. If it is not, replace the roller (Motorola Part Number 49A43659A03).
	3. Flywheel (4) and/or motor drive shaft (part of 2) dirty or greasy.	Use isopropyl (rubbing) alcohol to clean the following areas: outer edge of flywheel, motor drive shaft and capstan shaft.
	4. Defective or incorrectly installed drive belt (85).	Drive belt should be replaced if stretched or banana shaped; belt should be installed with paint stripe on outside.
	5. Cartridge retaining roller (22) not seated properly or missing.	Make certain roller is seated in spring (25); replace if missing.
	6. Scraping cartridge.	Examine left side of tape cartridge; if severely scored, lightly file off any burrs on left front edge of tape slot or escutcheon.
	7. Scored capstan shaft (part of 4).	Replace; if severely scored, replace capstan housing (58) also.
	8. Bent motor housing (81).	With cartridge inserted and operating, make certain drive belt rides on center of brass motor pulley; bend the motor housing using wide jawed pliers if necessary. If belt rides too high, bend the housing away from the capstan; if belt rides too low (rubs against housing), bend the housing toward the capstan. CAUTION: Do not bend the brass motor pulley.
Improper or erratic head indexing.	1. Inadequate tension on solenoid plunger tension spring (37).	Increase tension on spring or replace.
	2. Defective solenoid plunger (38).	Replace solenoid plunger.
	3. Head tension screw (78) out of adjustment.	Set the height of the screw so that there is 1/4" between bottom flat portion of the screw head and the head bracket (see "Head Adjustment Location" detail).
	4. Cam clutch spring (part of 39) out of hole or missing.	Insert spring into its hole or replace cam if spring is missing.

TAPE PLAYER TROUBLESHOOTING CHART (CON'T)

SYMPTOM	CAUSE	POSSIBLE SOLUTION
	5. Defective cam and ratchet assembly (39).	Replace cam.
	6. Head cable (79) binding.	Make certain head cable does not restrict up-and-down motion of head; dress head cable to minimize binding.
Motor noise from tape motor.	1. Open regulator filter capacitor (C-52).	Replace capacitor.
	2. Motor grounded to cover.	Check to see that bottom cover has an armite disc attached to it to insulate the motor case from the cover. If the disc is missing, electrical tape can be used to insulate the motor.
Squeaking or excessive wow.	1. Defective tape cartridge.	Check tape cartridge by inserting a known good cartridge.
	2. Broken or missing nylon capstan bearing (5).	Replace bearing; lubricate replacement bearing with silicon grease, Part No. 11M490487.
	3. Scored capstan shaft (part of 4).	Replace; if severely scored, replace capstan housing (58) also.
	4. Thrust plate (part of 58) loose or missing from bottom of capstan housing or defective bearings in capstan housing.	Replace capstan housing (58). Do not attempt to lubricate oilite bearings in capstan housing.
Drive belt slips off flywheel (also slow tape start up).	1. Defective or incorrectly installed drive belt (85).	Drive belt should be replaced if stretched or banana shaped; belt should be installed with paint stripe on outside.
	2. Loose motor mounting screws (82, 83, 84 and 86).	Tighten.
	3. Motor drive shaft (part of 2) not vertical.	Bend the motor housing slightly away from the capstan shaft using wide jawed pliers. CAUTION: Do not apply any pressure to the brass motor pulley.
Tape motor does not run when cartridge is inserted.	1. Micro-switch (10) not activated.	Bend actuating arm (11) far enough to activate micro-switch when cartridge is inserted.
	2. Defective micro-switch (10) or defect in motor or regulator circuit.	Check micro-switch by applying B+ voltage directly to emitter of regulator transistor. Also compare voltages in regulator circuit to those on schematic.
	3. Shorted regulator filter capacitor (C-52) or defective regulator transistor.	Replace suspected component(s).
Intermittent audio during tape operation.	1. Loose or intermittent head cable (79).	Make certain head cable is firmly plugged into head. Cable can be checked for intermittent(s) by wiggling; replace cable if necessary.
	2. Defective tape-radio switch, E-8, and/or associated circuitry.	Check switch action both electrically and mechanically; replace switch if necessary.
Unit will not switch from radio to tape and/or vice versa when cartridge is inserted or removed.	1. Radio-tape changeover switch, E-8, or actuating arm (part of switch) bent or defective	Check switch action both electrically and mechanically; replace switch if necessary.

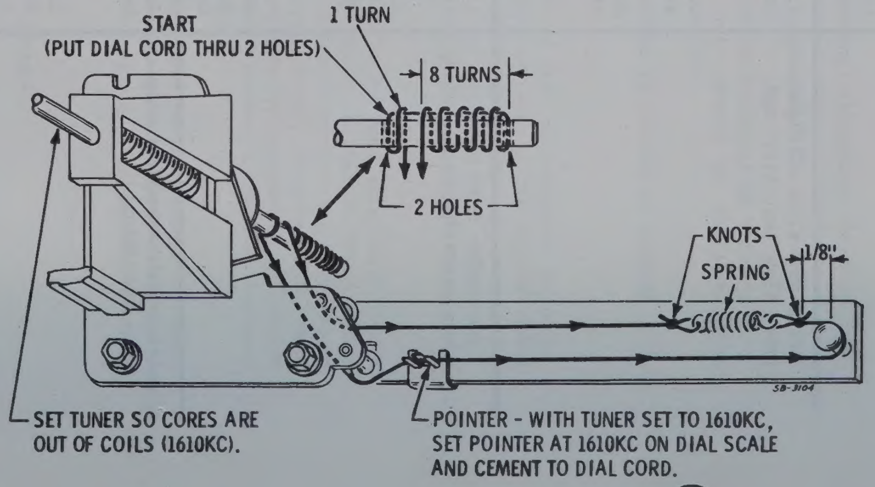

62 HEIGHT ADJUSTING SCREW
75 AZIMUTH ADJUSTING SCREW
"A"
65 TAPE GUIDE BRACKET
66 TAPE STOP
53 DECK SLIDE ROLLER
54 SPIRAL PIN
71 HEAD & BRACKET ASSEM
19 TRANSISTOR SOCKET
63, 76 BALL BEARING
10 MICRO SWITCH
6 ACTUATING ARM RETAINER
11 MICROSWITCH ACTUATING ARM
58 CAPSTAN HOUSING
77 CONICAL SPRING
64, 72 2-56 SCREW & NUT

TOP VIEW


38 PLUNGER & BRACKET ASSEM
37 PLUNGER TENSION SPRING
CAM CLUTCH SPRING (PART OF 39)
28 SOLENOID
1, 3 MOTOR SUPPORT
58 CAPSTAN HOUSING
4 FLYWHEEL & CAPSTAN
THRUST PLATE (PART OF 58)
59 FLYWHEEL RETAINING PIN
25 SPRING & ROLLER
21 DRIVE PIN
22 CARTRIDGE RETAINING ROLLER
23 TRANSFER PIN (UNDER CAM)
41 CAM TENSION PLUNGER
39 CAM & RATCHET ASSEMBLY
53 DECK SLIDE ROLLER
54 SPIRAL PIN
32 PRE-AMP PLATED CHASSIS BOARD
D. C. Motor
59C43543A02
NN80
6 6 2 9

BOTTOM VIEW

TAPE DECK PARTS LOCATION


START (PUT DIAL CORD THRU 2 HOLES)
1 TURN
8 TURNS
2 HOLES
KNOTS
SPRING
1/8"
SET TUNER SO CORES ARE OUT OF COILS (1610KC).
POINTER - WITH TUNER SET TO 1610KC, SET POINTER AT 1610KC ON DIAL SCALE AND CEMENT TO DIAL CORD.
58-3104

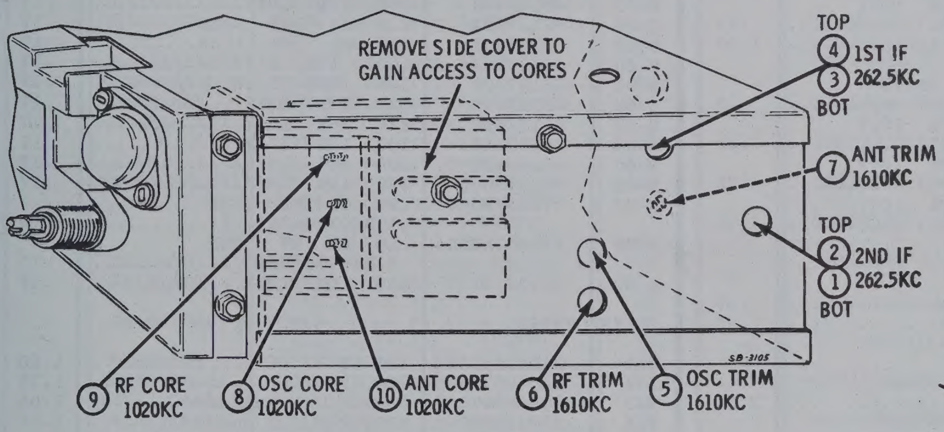
DIAL STRINGING

RADIO ALIGNMENT

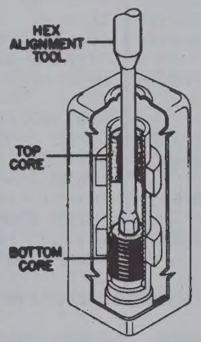
Connect an output meter across the speaker voice coil. Set volume to maximum and tone to treble. Attenuate signal generator output to maintain 2.83 volts (1 watt across 8 ohm load on either channel) on output meter at all times to prevent receiver overloading.

STEP	GENERATOR CONNECTION	GENERATOR FREQUENCY (400 cycle mod)	TUNER SET TO	ADJUST	REMARKS
IF ALIGNMENT					
1.	Antenna receptacle thru .1mf and chassis	262.5Kc	High end stop	1, 2, 3 & 4	Adjust for maximum.
RF ALIGNMENT					
2.	Antenna receptacle thru dummy (see Figure)	1610Kc	High end stop	5, 6 & 7	Adjust for maximum.
NOTE:	Do not perform Steps #3, #4, #5 and #6 unless tuner has been tampered with or components have been replaced. Before proceeding with Step #3, back tuning cores as far as possible out of coil forms to eliminate their effect on trimmer adjustments. Remove the side cover to gain access to the tuner cores.				
3.	Antenna receptacle thru dummy (see Figure).	1610Kc	High end stop	5, 6 & 7	Adjust for maximum.
4.	"	1020Kc	Tuner carriage 9/16" from high end stop	8, 9 & 10	Adjust for maximum.
5.	"	1610Kc	High end stop	5, 6 & 7	Adjust for maximum.
6.	Repeat Steps #4 and #5 until no further increase; Step #5 should be last step. Then cement cores in place.				
ANTENNA TRIMMER					
7.	---	---	Weak station between 1400 and 1600Kc	7	Adjust for maximum with radio installed in car and antenna fully extended.

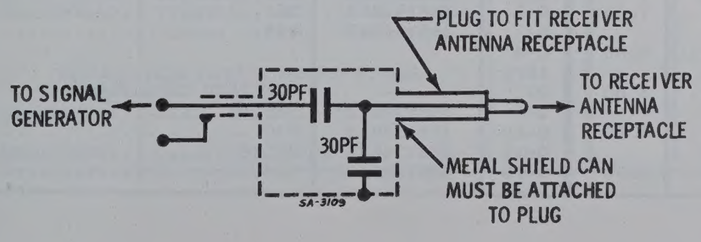
TO CALIBRATE POINTER - Tune radio to 1000Kc signal and reposition pointer on dial cable with the center of the 1000Kc mark on dial scale.


REMOVE SIDE COVER TO GAIN ACCESS TO CORES
TOP
④ 1ST IF
③ 262.5KC
BOT
⑦ ANT TRIM 1610KC
TOP
② 2ND IF
① 262.5KC
BOT
SB-3105
⑨ RF CORE 1020KC
⑧ OSC CORE 1020KC
⑩ ANT CORE 1020KC
⑥ RF TRIM 1610KC
⑤ OSC TRIM 1610KC

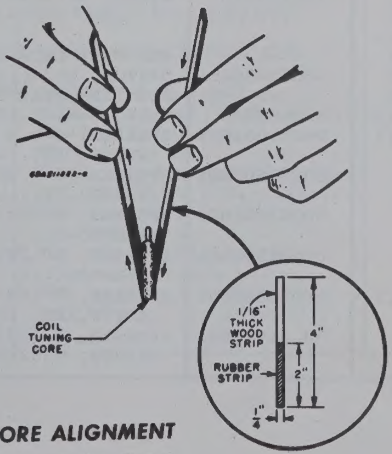
ALIGNMENT LOCATION DETAIL


HEX ALIGNMENT TOOL
TOP CORE
BOTTOM CORE

IF ALIGNMENT DETAIL


PLUG TO FIT RECEIVER ANTENNA RECEPTACLE
TO SIGNAL GENERATOR
30PF
30PF
TO RECEIVER ANTENNA RECEPTACLE
METAL SHIELD CAN MUST BE ATTACHED TO PLUG
SA-3109

DUMMY ANTENNA


COIL TUNING CORE
1/16" THICK WOOD STRIP
RUBBER STRIP
4"
2"
1/4"

CORE ALIGNMENT TOOL DETAIL

REPLACEMENT PARTS LIST

Ref. No.	Part Number	Description	List Price
		ELECTRICAL PARTS	
CAPACITORS - NOTE: The capacitors in this list are recommended replacement types for the original equipment; all are ceramic disc type unless otherwise specified.			
C-1	*20C40746A06	TRIMMER 110 to 380 pf	.85
C-2	21D40339A83	330 pf 20% 100V (USE 21K752589)	.25
C-3	20C40254A14	DUAL TRIMMER 30 to 150 pf; 30 to 150 pf	1.15
C-4	21D40536A30	180 pf 10% 100V N750	.20
C-5	8C42750A06	.01 mf 20% 100V mylar	.25
C-6	23C43280A02	2 mf +40-20% 10V lytic	.45
C-7	21C40367A19	250 pf 5% 100V	.40
C-8	8C42750A06	.01 mf 20% 100V mylar	.25
C-9	8C42750A06	.01 mf 20% 100V mylar	.25
C-10	21D40536A49	180 pf 5% 100V N750	.25
C-11	8C42750A20	.0047 mf 10% 100V mylar (USE 8C40906A27)	.30
C-12	21C40367A14	160 pf 5% 100V MICA (USE 21C40367A09)	.30
C-13	8C42750A35	.002 mf 10% 100V mylar	.30
C-14	8C42750A13	.1 mf 20% 100V mylar (USE 8C40906A05)	.35
C-15	23C43280A03	10 mf +40-20% 6V lytic	.55
C-16	21C40339A44	150 pf 10% 100V	.20
C-17	8C42750A06	.01 mf 20% 100V mylar	.25
C-18	23C40302A07	500-500 mf/16V lytic (USE 23C40302A04)	3.40
C-20 thru C-29	---	SEE TAPE DECK PARTS	
C-30	23C41928A33	32 mf 10V lytic	.65
C-31	23C41928A33	32 mf 10V lytic	.65
C-32	23C43280A21	.5 mf +40-20% 15V lytic	.30
C-33	23C43280A21	.5 mf +40-20% 15V lytic	.30
C-34	23C43280A14	.1 mf +40-20% 15V lytic	.35
C-35	23C43280A14	.1 mf +40-20% 15V lytic	.35
C-36	21C41680A15	.22 mf +80-20% 12V	.35
C-37	21C41680A15	.22 mf +80-20% 12V	.35
C-38	23C43280A02	2 mf +40-20% 10V lytic	.45
C-39	23C43280A02	2 mf +40-20% 10V lytic	.45
C-40	21D40339A87	.0015 mf 10% 100V	.20
C-41	21D40339A87	.0015 mf 10% 100V	.20
C-42	21D40536A50	22 pf 10% 100V N150 (USE 21R120539)	.25
C-43	21D40536A50	22 pf 10% 100V N150 (USE 21R120539)	.25
C-44	23C41928A23	80 mf 16V lytic	.65
C-45	23C41928A23	80 mf 16V lytic	.65
C-46	21D40339A87	.0015 mf 10% 100V	.20
C-47	21D40339A87	.0015 mf 10% 100V	.20
C-48	23C41928A29	1000 mf 16V lytic	1.65
C-49	21D40339A78	.01 mf +80-20% 100V (USE 21K132103)	.25
C-50	23C41928A29	1000 mf 16V lytic	1.65
C-51, C-52	---	SEE TAPE DECK PARTS	
C-53	8C40906A05	.1 mf 20% 100V mylar	.35
C-54	21D40339A78	.01 mf +80-20% 100V (USE 21K132103)	.25
C-55	21D40339A78	.01 mf +80-20% 100V (USE 21K132103)	.25
C-56	21D40339A78	.01 mf +80-20% 100V (USE 21K132103)	.25
MISCELLANEOUS ELECTRICAL PARTS			
E-1	48S134816	DIODE, silicon	.35
E-2	48S134816	DIODE, silicon	.35
E-3 thru E-7	---	SEE TAPE DECK PARTS	
E-8	40B43656A01	SWITCH, radio tape	2.35
E-9	---	SEE TAPE DECK PARTS	
E-10	65S538410	BULB, dial: .11A-14.4V	.35
E-11	50C41451B01	SPEAKER, 4 x 8 PM: 8Ω VC (A7MVF, VS)	9.60
	50C41607B01	SPEAKER, 5-1/4" PM: 8Ω VC (A7MVG)	7.05
	50C41485B01	SPEAKER, 6" PM: 8Ω VC (A7MVT)	6.60
	50C41265B01	SPEAKER, 5" PM: 8Ω VC (A7MVW)	6.60
E-12	50C41265B01	SPEAKER, 5" PM: 8Ω VC (A7MVF, VG, VW)	6.60
	50C41485B01	SPEAKER, 5-1/4" PM: 8Ω VC (A7MVS, VT)	6.60
E-13	---	SEE TAPE DECK PARTS	
E-14	65S122346	FUSE, 7.5 amp	.10
E-15	50C41265B01	SPEAKER, 5" PM: 8Ω VC (A7MVF)	6.60
	50C41485B01	SPEAKER, 5-1/4" PM: 8Ω VC (A7MVT)	6.60
COILS & CHOKES			
L-1, L-2, L-3	---	SEE TUNER PARTS	
L-4	25D43221A24	FILTER CHOKE	3.95
CONTROLS & RESISTORS			
R-1	6S127800	220 10% 1/4W	.17
R-2	6S127800	220 10% 1/4W	.17
R-3	6S129775	330 10% 1/4W	.17
R-4	6S129144	82K 10% 1/4W	.17
R-5	6S129144	68K 10% 1/4W	.17
R-6	6S127806	27K 10% 1/4W	.17
R-7	6S129981	3300 5% 1/4W	.33
R-8	6S128689	2200 10% 1/4W	.17
R-9	6S128687	6800 10% 1/4W	.17
R-10	6S127804	4700 10% 1/4W	.17
R-11	6S127807	33K 10% 1/4W	.17
R-12	6S129226	100K 10% 1/4W	.17
R-13	6S127800	220 10% 1/4W	.17
R-14	6S128687	6800 10% 1/4W	.17
R-15	6S129146	150K 10% 1/4W	.17
R-16	6S127803	1500 10% 1/4W	.17
R-17	6S127633	470 10% 1/2W	.17
R-18, R-19	---	SEE TAPE DECK PARTS	
R-20	6S129148	470K 10% 1/4W	.17
R-21 thru R-36	---	SEE TAPE DECK PARTS	
R-39	6S121301	1000 10% 1/2W	.17
R-40	6S121301	1000 10% 1/2W	.17
R-41	*18C40587B01	CONTROL, balance	1.55
R-42	6S128689	2200 10% 1/4W	.17
R-43	6S128689	2200 10% 1/4W	.17
R-44	6S127803	1500 10% 1/4W	.17
R-45	6S127803	1500 10% 1/4W	.17
R-46	18C40483B01	CONTROL, multiple	9.60
R-48	6S121301	1000 10% 1/2W	.17
R-49	6S121301	1000 10% 1/2W	.17
R-50	6S129147	220K 10% 1/4W	.17
R-51	6S131377	15 10% 1/4W	.17
R-52	6S129147	220K 10% 1/4W	.17
R-53	6S131377	15 10% 1/4W	.17
R-54	6S129433	5600 10% 1/4W	.17
R-55	6S129433	5600 10% 1/4W	.17
R-56	6S128903	39K 10% 1/4W	.17
R-57	6S128903	39K 10% 1/4W	.17
R-58	6S127001	2.2 meg 10% 1/2W	.17
R-59	6S127001	2.2 meg 10% 1/2W	.17
R-60	6S127802	1000 10% 1/4W	.17
R-61	6S127802	1000 10% 1/4W	.17
R-62	6S127099	220 10% 1/2W	.17
R-63	6S127099	220 10% 1/2W	.17
R-64	6S129753	100 10% 1/4W	.17
R-65	6S129753	100 10% 1/4W	.17
R-66	6S127800	220 10% 1/4W	.17
R-67	17B40756A04	.20 5% WW (USE 17B40756A06)	.15
R-68	17B40756A04	.20 5% WW (USE 17B40756A06)	.15
R-69	6S129101	680 10% 1/2W	.17
TRANSFORMERS			
T-1	24D42517A27	1ST IF	1.60
T-2	24D42517A28	2ND IF	1.75
T-3	25D41307B07	OUTPUT (left channel)	1.55
T-4	25D41307B05	OUTPUT (left channel)	1.55
TRANSISTORS			
Q-1	48S134805	25B	1.45
Q-2	48S134804	25A	1.45
Q-3	48S134807	24B	1.45
Q-4 thru Q-7	---	SEE TAPE DECK PARTS	
Q-9	48S134810	54C	1.45
Q-10	48S134810	54C	1.45
Q-11	48S134747	2N176	3.25
Q-13	48S134810	54C	1.45

Ref. No.	Part Number	Description	List Price
Q-14	48S134810	54C......................	1.45
Q-15	48S134747	2N176.....................	3.25
Q-16	---	SEE TAPE DECK PARTS	
		MECHANICAL PARTS	
	*13D41017B07	BEZEL, radio (A7MVF, VS)...	9.70
	*13D40655B04	BEZEL, radio (A7MVG, VT)...	3.45
	*13D40655B01	BEZEL, radio (A7MVW).......	3.90
	84D43708A05	BOARD, plated audio........	2.10
	84D43707A01	BOARD, plated RF...........	1.10
	3A40730A03	BOLT, radio mtg: 1/4-20 x 5/8..............	.03
	7A40566B02	BRACKET, radio mtg (A7MVF, VS)...............	.15
	*30B41610B01	CABLE, rear spkr: incl all conn (A7MVF)..............	3.45
	*30B41610B02	CABLE, rear spkr: incl all conn (A7MVT)..............	4.50
	7C43782A01	CAM, BRCKT & ROLLER ASSEM: radio tape sw............	
	15D40565B01	COVER, bottom.............	.70
	15D40563B01	COVER, top................	.65
	15C41588B01	COVER, trim: between radio & dash (A7MVF, VS)........	
	15D40686B01	COVER, trim; lge: radio (A7MVF, VS)...............	1.20
	*61B40602B01	CRYSTAL, dial..............	.75
	*15C41109B03	DOOR, tape cartridge.......	6.75
	13C40658B01	GRILLE, spkr (A7MVG, VT)...	1.60
	15C40810B01	HOUSING, spkr: rear (A7MVT)...................	1.95
	14D40596A01	INSULATOR, female: 3-cond spkr leads................	.05
	14A42296A01	INSULATOR, male: 2-cond spkr leads (A7MVG, VS,VW).	.10
	14A543810	INSULATOR, trans...........	.10
	36C40039B01	KNOB, tone & bal (A7MVF, VS)......................	.35
	36B40252B01	KNOB, vol-tuning-indexing (A7MVF, VS)...............	.40
	29A541679	LUG, term: blade type (spkr leads)..............	.05
	29K534326	LUG, term: dial & spkr leads.....................	.05
	29C41506A01	LUG, term: fuse recept.....	.20
	33B41611B01	NAMEPLATE: "Eight Track Stereo" (A7MVF, VS).......	.50
	2S135435	NUT, hex: 1/4-20 (radio mtg-rear).................	.03
	2S124821	NUT, hex: 1/2-28 (front radio mtg - A7MVF, VS)....	.15
	2S129892	NUT, hex: 8-32 x 5/16 (spkr to plate - A7MVF, VG, VW).	.05
	2B43951A01	NUT, spring: #8-15 (rear spkr mtg - A7MVT).........	.03
	*64C40611B01	PLATE, adaptor (A7MVF, VG).	.75
	64C41371B01	PLATE, spkr mtg (A7MVF, VG, VW).......................	2.85
	64D42417A03	PLATE, spkr mtg (A7MVT)....	
	*52B40654B01	POINTER, dial..............	.50
	9A531066	RECEPTACLE, ant............	.15
	*9C41095A27	RECEPTACLE, fuse: incl fuse......................	1.00
	47A43513A02	ROD, cartridge door........	.15
	*34B40603B01	SCALE, dial................	.35
	3S122021	SCREW, mach: 8-32 x 9/16 (spkr to plate - A7MVF, VG, VW)..................	.05
	3K560695	SCREW, spcl: trans mtg.....	.03
	3S127896	SCREW, tpg: #4-40 x 1/4 (cam assem mtg)...........	.03
	3B40410A07	SCREW, tpg: #8-15 x 1-1/4 (rear spkr mtg - A7MVT)...	.10
	9K562925	SOCKET, dial lite..........	.30
	9C43089A01	SOCKET, trans..............	.25
	*41A43588A01	SPRING, cartridge door.....	.15
	41A63638A01	SPRING, tension: pointer...	.15
	*42K565373	STRAP, radio mtg (A7MVF, VG, VS, VW)...............	.30
	46K565358	STUD, trimount: trim cover.	.10
	29D40600A02	TERMINAL, lug: spkr leads..	.10
	29C40595A01	TERMINAL, male: 2-cond spkr leads (A7MVG, VS).........	.10
		INSTALLATION PARTS - MODEL A7MVF	
	*1V41500B09	RADIO INSTALLATION KIT.....	
	8B40353B01	CAPACITOR, generator.......	.80
	14A64196A01	INSULATOR, splice..........	.15
	29A42410A01	LUG, adaptor: dial light...	.10
	2S410091	NUT, hex: 1/4-20...........	.05
	2A563491	NUT, hex; spcl: 1/4-20 (strap to radio mtg.........	.03
	2S131997	NUT, keps: 10-24 x 3/8.....	.05
	*3S122358	SCREW, mach: 1/4-20 x 3/8..	
	*3S1940	SCREW, mach: 10-24 x 1/2...	.03
	*3S125452	SCREW, tpg: #8-15 x 1/2 (front spkr mtg)..........	
	3S135712	SCREW, tpg: #8-32 x 1/4 (brkt to radio mtg).......	.05
	3S135757	SCREW, tpg: #10-12 x 1/2 (brkt to dash mtg)........	.03
	3S135147	SCREW, tpg: #10-12 x 1/2 (strap mtg)...............	.03
	3S135175	SCREW, tpg: #10-12 x 3/4 (brkt mtg)................	.05
	41B42528A01	SPRING, static coil........	.40
	29A64295A01	TERMINAL; female: splice...	.05
		INSTALLATION PARTS - MODEL A7MVG	
	*1V41300B79	RADIO INSTALLATION KIT.....	
	8B40353B01	CAPACITOR, generator.......	.80
	5S10115A10	GROMMET, insul: spkr leads.	.10
	14A64196A01	INSULATOR, splice..........	.15
	36C40039B01	KNOB, tone-bal.............	.35
	36B40252B01	KNOB, vol-tuning-indexing..	.40
	29A42410A01	LUG, adaptor: dial lite....	.10
	2S124821	NUT, hex: 1/2-28 (front radio mtg)................	.15
	2A563491	NUT, hex; spcl: 1/4-20 (strap to radio mtg)......	.03
	3S125452	SCREW, tpg: #8-15 x 1/2 (front spkr mtg)..........	
	3S135147	SCREW, tpg: #10-12 x 1/2 (strap mtg)...............	.03
	3S135175	SCREW, tpg: #10-12 x 3/4 (brkt mtg)................	.05
	41B42528A01	SPRING, static coil........	.40
	29A64295A01	TERMINAL, female: splice...	.05
		INSTALLATION PARTS - MODEL A7MVS	
	*1V41500B10	RADIO INSTALLATION KIT.....	
	8B40353B01	CAPACITOR, generator.......	.80
	14A64196A01	INSULATOR, splice..........	.15
	29A42410A01	LUG, adaptor: dial lite....	.10
	2S410091	NUT, hex: 1/4-20...........	.05
	2A563491	NUT, hex; spcl: 1/4-20 (strap to radio mtg)......	.03
	2S131997	NUT, keps: 10-24 x 3/8.....	.05
	2B43951A01	NUT, spring: #8-15 (rear spkr mtg)................	.03
	3S122358	SCREW, mach: 1/4-20 x 3/8..	
	3S1940	SCREW, mach: #10-24 x 1/2..	.03
	3S125452	SCREW, tpg: #8-15 x 1/2 (front spkr mtg)..........	
	3B40410A07	SCREW, tpg: #8-15 x 1-1/4 (rear spkr mtg)...........	.10
	3S135712	SCREW, tpg: #8-32 x 1/4 (brkt to radio mtg).......	.05
	3S135757	SCREW, tpg: #10-12 x 1/2 (brkt to dash mtg)........	.03
	3S135147	SCREW, tpg: #10-12 x 1/2 (strap mtg)...............	.03
	3S135175	SCREW, tpg: #10-12 x 3/4 (brkt mtg)................	.05
	41B42528A01	SPRING, static coil........	.40
		INSTALLATION PARTS - MODEL A7MVT	
	*1V41500B12	RADIO INSTALLATION KIT.....	
	8B40353B01	CAPACITOR, generator.......	.80
	5S10115A10	GROMMET, insul: spkr leads.	.10
	14A64196A01	INSULATOR, splice..........	.15
	36C40039B01	KNOB, tone-bal.............	.35
	36B40252B01	KNOB, vol-tuning-indexing..	.40
	29A42410A01	LUG, adaptor: dial light...	.10
	2S124821	NUT, hex: 1/2-28 (front radio mtg)................	.15
	2A563491	NUT, hex; spcl: 1/4-20 (strap to radio mtg)......	.03
	2S410091	NUT, kepts: 1/4-20 (strap mtg).....................	.05

Ref. No.	Part Number	Description	List Price
	2B43951A01	NUT, spring: #8-15 (rear spkr mtg)	.03
	3S122358	SCREW, mach: 1/4-20 x 3/8	
	*3S125886	SCREW, tpg: #8-15 x 5/8; S L XHD	
	3S134015	SCREW, tpg: #8-15 x 5/8; PL X-W	.05
	3S125452	SCREW, tpg: #8-15 x 1/2 (front spkr mtg)	
	3B40410A07	SCREW, tpg: #8-15 x 1-1/4 (rear spkr mtg)	.10
	3S134145	SCREW, tpg: #10-12 x 3/8; PHL PAN	
	3S135147	SCREW, tpg: #10-12 x 1/2 (front spkr mtg)	.03
	3S135175	SCREW, tpg: #10-12 x 3/4 (brkt mtg)	.05
	41B42528A01	SPRING, static coil	.40
	*42K565383	STRAP, radio mtg	.25
	29A64295A01	TERMINAL, female: splice	.05

INSTALLATION PARTS - MODEL A7MVW

Ref. No.	Part Number	Description	List Price
	*1V40800B18	RADIO INSTALLATION KIT	
	8B40353B01	CAPACITOR, generator	.80
	5S10115A10	GROMMET, insul: spkr leads.	.10
	36C40039B01	KNOB, tone-bal	.35
	36B41423B01	KNOB, vol-tuning-indexing	.50
	14A64196A01	INSULATOR, splice	.15
	29A42410A01	LUG, adaptor: dial lite	.10
	2S124821	NUT, hex: 1/2-28 (radio mtg)	.15
	2A563491	NUT, hex; spcl: 1/4-20 (strap mtg)	.03
	3S135147	SCREW, tpg: #10-12 x 1/2 (front spkr mtg)	.03
	3S135175	SCREW, tpg: #10-12 x 3/4 (rear spkr mtg)	.05
	41B42528A01	SPRING, static coil	.40
	29A64295A01	TERMINAL, female: splice	.05

TUNER PARTS - ALL MODELS

Ref. No.	Part Number	Description	List Price
	*1U43500A16	TUNER, MFT603: complete	12.75
	*1V40400B33	COILS & MTG PLATE ASSEM: incl L-1, L-2, L-3	3.35
	76C40706A10	CORE, tuning: ant & RF	.10
	76C40647A10	CORE, tuning: osc	.10
	5B562438	GROMMET, core mtg	.10
	*47B40665B01	SHAFT, tuning: incl ring & washers	1.00
	*41B40749B01	SPRING, shaft ret	.15

TAPE DECK PARTS - ALL MODELS

ELECTRICAL PARTS

CAPACITORS - NOTE: The capacitors in this list are recommended replacement types for the original equipment; all are ceramic disc type unless otherwise specified.

Ref. No.	Part Number	Description	List Price
C-20	23C41928A24	20 mf 16V lytic	.65
C-21	23C41928A24	20 mf 16V lytic	.65
C-22	23C41928A06	16 mf 16V lytic	.90
C-23	23C41928A06	16 mf 16V lytic	.90
C-26	23C41928A23	80 mf 16V lytic	.65
C-27	23C41928A23	80 mf 16V lytic	.65
C-28	8C42750A20	.0047 mf 10% 100V mylar (USE 8-40906A27)	.30
C-29	8C42750A20	.0047 mf 10% 100V mylar (USE 8-40906A27)	.30
C-51	8C40906A05	.1 mf 20% 100V mylar	.35
C-52	23S187A06	1000 mf 16V lytic	.65

MISCELLANEOUS ELECTRICAL PARTS

Ref. No.	Part Number	Description	List Price
E-3	59C43543A02	MOTOR, regulated DC	21.95
E-4	80B43685A01	SOLENOID	3.90
E-5	40B43677A01	SWITCH, micro	2.00
E-6	40B43642A01	SWITCH, leaf contact	1.20
E-7	1B43784A01	STEREO HEAD & BRACKET ASSEM (USE 59P40059A36)	13.25
E-8	---	SEE ELECTRICAL PARTS	
E-9	30C40643B02	CABLE, stereo head	1.35
E-13	48S41508A01	RECTIFIER, silicon	1.00

RESISTORS

Ref. No.	Part Number	Description	List Price
R-18	6S127099	220 10% 1/2W	.17
R-19	6S128224	12 10% 1/2W	.17
R-21	6S128902	47K 10% 1/4W	.17
R-22	6S128902	47K 10% 1/4W	.17
R-23	6S129662	180 10% 1/4W	.17
R-24	6S129662	180 10% 1/4W	.17
R-25	6S128902	47K 10% 1/4W	.17
R-26	6S128902	47K 10% 1/4W	.17
R-27	6S127513	1500 10% 1/2W	.17
R-28	6S127513	1500 10% 1/2W	.17
R-29	6S129753	100 10% 1/4W	.17
R-30	6S129753	100 10% 1/4W	.17
R-31	6S127802	1000 10% 1/4W	.17
R-32	6S127802	1000 10% 1/4W	.17
R-33	6S128686	8200 10% 1/4W	.17
R-34	6S128686	8200 10% 1/4W	.17
R-35	6S125568	22K 10% 1/2W	.17
R-36	6S125568	22K 10% 1/2W	.17

TRANSISTORS

Ref. No.	Part Number	Description	List Price
Q-4	48S134823	M822	1.50
Q-5	48S134665	M54 (USE 48S134846)	1.50
Q-6	48S134823	M822	1.50
Q-7	48S134665	M54 (USE 48S134846)	1.50
Q-16	48S134746	2N176 (USE 48S134747)	3.25

TAPE DECK MECHANICAL PARTS

Ref. No.	Part Number	Description	List Price
1,3	7A43576A01	SUPPORT, motor: rubber	.15
2	---	SEE E-3 IN ELECTRICAL PARTS	
4	49B43791A01	FLYWHEEL & SHAFT ASSEM	9.25
5	43A43867A01	BEARING, nylon (flywheel & shaft)	.05
6	26A40607B01	RETAINER, actuating arm	.05
7	3S132645	SCREW, tpg: 4-40 x 7/32 (act arm ret)	.03
8,9	3S122820	SCREW, tpg: 4-40 x 5/8 (micro sw mtg)	.03
10	---	SEE E-5 IN ELECTRICAL PARTS	
11	45B40480B01	ARM, micro-switch actuating	.25
13,14	3K564805	SCREW, spcl: transistor mtg	.03
15	---	SEE Q-16 IN ELECTRICAL PARTS	
16	14A543810	INSULATOR, transistor	.10
19	9K561755	SOCKET, transistor	.25
21	22C42038A05	PIN, drive: cartridge roller	.05
22	49A41281B01	ROLLER, cartridge tension: metal	.20
23	22A43573A01	PIN, transfer: .288-.292	.55
25	41P40059A48	SPRING, ROLLER & PIN ASSEM: cartridge tension	
28	---	SEE E-4 IN ELECTRICAL PARTS	
32	84D43709A03	BOARD, plated chassis: pre-amp; less all components	1.75
37	41A43742A01	SPRING, plunger tension	.10
38	47P40059A24	PLUNGER, BRACKET & ACTUATOR ASSEM	3.00
39	45B43929A01	CAM & RATCHET ASSEM	1.95
40	43K471633	BEARING, ball: 3/32	.01
41	47A40181B01	PLUNGER, cam tension	.35
42	41A40180B01	SPRING	.05
53	49A43659A03	ROLLER, deck slide: plastic	.25
54	22B43667A03	PIN, spiral: deck slide roller	.05
58	15P40059A28	CAPSTAN HOUSING ASSEM	3.25
59	22C42038A02	PIN, flywheel retaining	.05
60	41B43609A03	SPRING, head bracket mtg	.25
62	3T43787A01	SCREW, spcl: 4-40 x 1/4 (height adjust)	.25
63	43K471633	BEARING, ball: 3/32"	.01
64	2S7041	NUT, hex: 2-56 x 3/16 (stereo head)	.03
65	7B43531A01	BRACKET, tape guide	.20
66	46B40913B01	STOP, tape: nylon; tape guide brkt	.40
67	---	SEE E-6 IN ELECTRICAL PARTS	
71	---	SEE E-7 IN ELECTRICAL PARTS	
71A	---	BRACKET, tape head mtg (part of 71)	
72	3S135441	SCREW, machine: 2-56 x 1/4 (head mtg)	.05
73	41A40180B01	SPRING	.05
75	3T43787A02	SCREW, special: 4-40 x 5/8 (azimuth adjust)	.85
76	43K471633	BEARING, ball: 3/32	.01
77	41B43778A01	SPRING, conical: head adjust screw	.10
78	3S6961	SCREW, mach: 4-40 x 3/4 (head tension adj)	.03

(Cont'd on Page 21)

Ref. No.	Part Number	Description	List Price
79	---	SEE E-9 IN ELECTRICAL PARTS	
81	26B43657A01	SHIELD, motor mtg..........	1.10
85	42B43871A01	BELT, drive................	.75
		ACCESSORY SERVICE AIDS AND TOOLS	
	99P43309A01	CARTRIDGE, test tape.......	17.40
	68P40059A33	DISC, strobe (flywheel)....	
	*11P40059A53	GLYPTAL (for cementing adjustment screws)........	
	11M490487	GREASE, silicon............	2.30
	11P40059A55	GREASE, special, light-weight low-temperature type......................	
	66P40059A32	WRENCH, 1/16" allen head (for azimuth & height adjustment)...............	2.50

*DENOTES NEW ITEM APPEARING IN ANY LIST FOR FIRST TIME.

Ref. No.	Part Number	Description	List Price
	2B43951A01	NUT, spring: #8-15 (rear spkr mtg)	.03
	3S122358	SCREW, mach: 1/4-20 x 3/8	
	*3S125886	SCREW, tpg: #8-15 x 5/8; S L XHD	
	3S134015	SCREW, tpg: #8-15 x 5/8; PL X-W	.05
	3S125452	SCREW, tpg: #8-15 x 1/2 (front spkr mtg)	
	3B40410A07	SCREW, tpg: #8-15 x 1-1/4 (rear spkr mtg)	.10
	3S134145	SCREW, tpg: #10-12 x 3/8; PHL PAN	
	3S135147	SCREW, tpg: #10-12 x 1/2 (front spkr mtg)	.03
	3S135175	SCREW, tpg: #10-12 x 3/4 (brkt mtg)	.05
	41B42528A01	SPRING, static coil	.40
	*42K565383	STRAP, radio mtg	.25
	29A64295A01	TERMINAL, female: splice	.05

INSTALLATION PARTS - MODEL A7MVW

Ref. No.	Part Number	Description	List Price
	*1V40800B18	RADIO INSTALLATION KIT	
	8B40353B01	CAPACITOR, generator	.80
	5S10115A10	GROMMET, insul: spkr leads.	.10
	36C40039B01	KNOB, tone-bal	.35
	36B41423B01	KNOB, vol-tuning-indexing	.50
	14A64196A01	INSULATOR, splice	.15
	29A42410A01	LUG, adaptor: dial lite	.10
	2S124821	NUT, hex: 1/2-28 (radio mtg)	.15
	2A563491	NUT, hex; spcl: 1/4-20 (strap mtg)	.03
	3S135147	SCREW, tpg: #10-12 x 1/2 (front spkr mtg)	.03
	3S135175	SCREW, tpg: #10-12 x 3/4 (rear spkr mtg)	.05
	41B42528A01	SPRING, static coil	.40
	29A64295A01	TERMINAL, female: splice	.05

TUNER PARTS - ALL MODELS

Ref. No.	Part Number	Description	List Price
	*1U43500A16	TUNER, MFT603: complete	12.75
	*1V40400B33	COILS & MTG PLATE ASSEM: incl L-1, L-2, L-3	3.35
	76C40706A10	CORE, tuning: ant & RF	.10
	76C40647A10	CORE, tuning: osc	.10
	5B562438	GROMMET, core mtg	.10
	*47B40665B01	SHAFT, tuning: incl ring & washers	1.00
	*41B40749B01	SPRING, shaft ret	.15

TAPE DECK PARTS - ALL MODELS

ELECTRICAL PARTS

CAPACITORS - NOTE: The capacitors in this list are recommended replacement types for the original equipment; all are ceramic disc type unless otherwise specified.

Ref. No.	Part Number	Description	List Price
C-20	23C41928A24	20 mf 16V lytic	.65
C-21	23C41928A24	20 mf 16V lytic	.65
C-22	23C41928A06	16 mf 16V lytic	.90
C-23	23C41928A06	16 mf 16V lytic	.90
C-26	23C41928A23	80 mf 16V lytic	.65
C-27	23C41928A23	80 mf 16V lytic	.65
C-28	8C42750A20	.0047 mf 10% 100V mylar (USE 8-40906A27)	.30
C-29	8C42750A20	.0047 mf 10% 100V mylar (USE 8-40906A27)	.30
C-51	8C40906A05	.1 mf 20% 100V mylar	.35
C-52	23S187A06	1000 mf 16V lytic	.65

MISCELLANEOUS ELECTRICAL PARTS

Ref. No.	Part Number	Description	List Price
E-3	59C43543A02	MOTOR, regulated DC	21.95
E-4	80B43685A01	SOLENOID	3.90
E-5	40B43677A01	SWITCH, micro	2.00
E-6	40B43642A01	SWITCH, leaf contact	1.20
E-7	1B43784A01	STEREO HEAD & BRACKET ASSEM (USE 59P40059A36)	13.25
E-8	---	SEE ELECTRICAL PARTS	
E-9	30C40643B02	CABLE, stereo head	1.35
E-13	48S41508A01	RECTIFIER, silicon	1.00

RESISTORS

Ref. No.	Part Number	Description	List Price
R-18	6S127099	220 10% 1/2W	.17
R-19	6S128224	12 10% 1/2W	.17
R-21	6S128902	47K 10% 1/4W	.17
R-22	6S128902	47K 10% 1/4W	.17
R-23	6S129662	180 10% 1/4W	.17
R-24	6S129662	180 10% 1/4W	.17
R-25	6S128902	47K 10% 1/4W	.17
R-26	6S128902	47K 10% 1/4W	.17
R-27	6S127513	1500 10% 1/2W	.17
R-28	6S127513	1500 10% 1/2W	.17
R-29	6S129753	100 10% 1/4W	.17
R-30	6S129753	100 10% 1/4W	.17
R-31	6S127802	1000 10% 1/4W	.17
R-32	6S127802	1000 10% 1/4W	.17
R-33	6S128686	8200 10% 1/4W	.17
R-34	6S128686	8200 10% 1/4W	.17
R-35	6S125568	22K 10% 1/2W	.17
R-36	6S125568	22K 10% 1/2W	.17

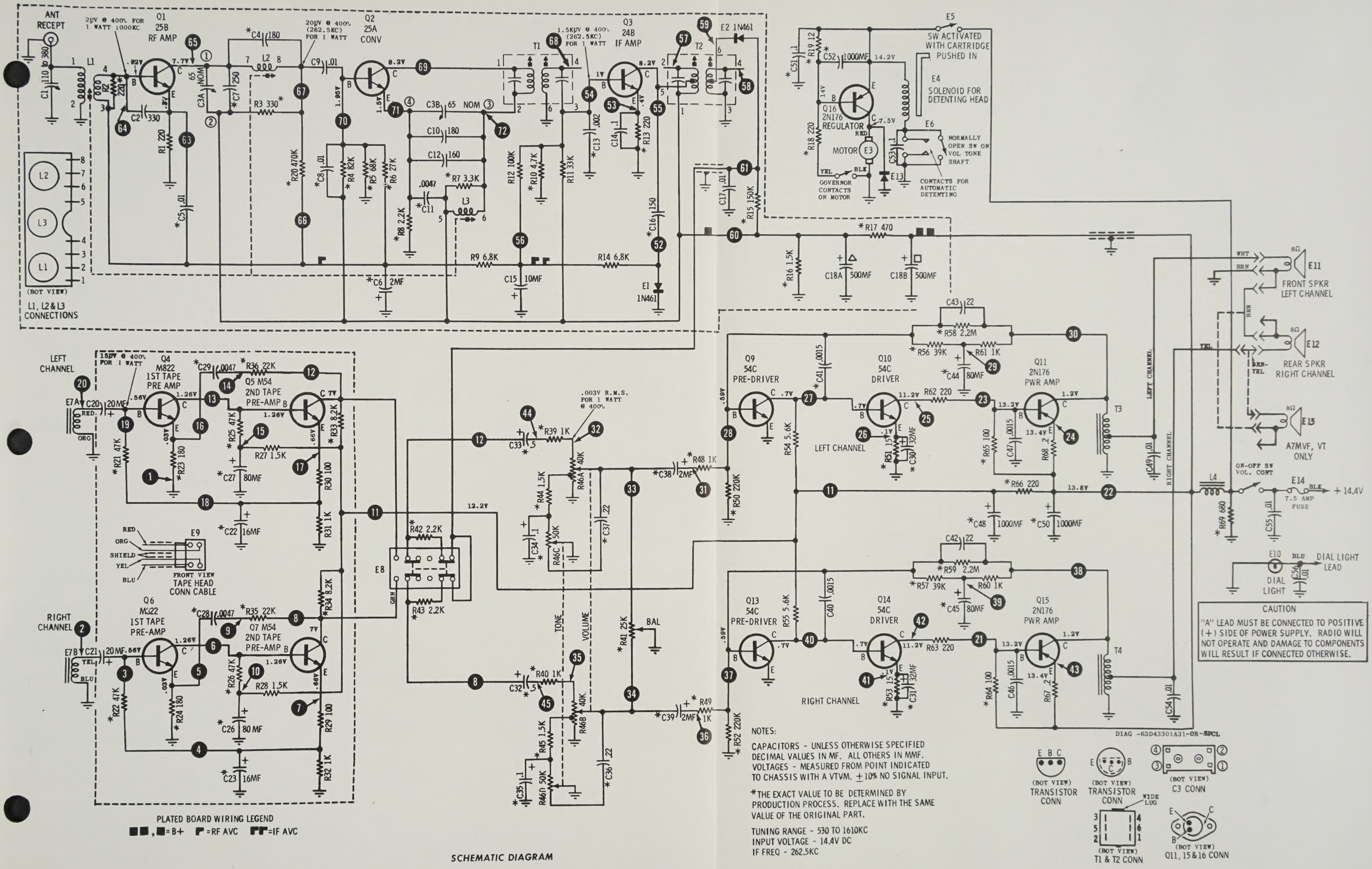
TRANSISTORS

Ref. No.	Part Number	Description	List Price
Q-4	48S134823	M822	1.50
Q-5	48S134665	M54 (USE 48S134846)	1.50
Q-6	48S134823	M822	1.50
Q-7	48S134665	M54 (USE 48S134846)	1.50
Q-16	48S134746	2N176 (USE 48S134747)	3.25

TAPE DECK MECHANICAL PARTS

Ref. No.	Part Number	Description	List Price
1,3	7A43576A01	SUPPORT, motor: rubber	.15
2	---	SEE E-3 IN ELECTRICAL PARTS	
4	49B43791A01	FLYWHEEL & SHAFT ASSEM	9.25
5	43A43867A01	BEARING, nylon (flywheel & shaft)	.05
6	26A40607B01	RETAINER, actuating arm	.05
7	3S132645	SCREW, tpg: 4-40 x 7/32 (act arm ret)	.03
8,9	3S122820	SCREW, tpg: 4-40 x 5/8 (micro sw mtg)	.03
10	---	SEE E-5 IN ELECTRICAL PARTS	
11	45B40480B01	ARM, micro-switch actuating	.25
13,14	3K564805	SCREW, spcl: transistor mtg	.03
15	---	SEE Q-16 IN ELECTRICAL PARTS	
16	14A543810	INSULATOR, transistor	.10
19	9K561755	SOCKET, transistor	.25
21	22C42038A05	PIN, drive: cartridge roller	.05
22	49A41281B01	ROLLER, cartridge tension: metal	.20
23	22A43573A01	PIN, transfer: .288-.292	.55
25	41P40059A48	SPRING, ROLLER & PIN ASSEM: cartridge tension	
28	---	SEE E-4 IN ELECTRICAL PARTS	
32	84D43709A03	BOARD, plated chassis: pre-amp; less all components	1.75
37	41A43742A01	SPRING, plunger tension	.10
38	47P40059A24	PLUNGER, BRACKET & ACTUATOR ASSEM	3.00
39	45B43929A01	CAM & RATCHET ASSEM	1.95
40	43K471633	BEARING, ball: 3/32	.01
41	47A40181B01	PLUNGER, cam tension	.35
42	41A40180B01	SPRING	.05
53	49A43659A03	ROLLER, deck slide: plastic	.25
54	22B43667A03	PIN, spiral: deck slide roller	.05
58	15P40059A28	CAPSTAN HOUSING ASSEM	3.25
59	22C42038A02	PIN, flywheel retaining	.05
60	41B43609A03	SPRING, head bracket mtg	.25
62	3T43787A01	SCREW, spcl: 4-40 x 1/4 (height adjust)	.25
63	43K471633	BEARING, ball: 3/32"	.01
64	2S7041	NUT, hex: 2-56 x 3/16 (stereo head)	.03
65	7B43531A01	BRACKET, tape guide	.20
66	46B40913B01	STOP, tape: nylon; tape guide brkt	.40
67	---	SEE E-6 IN ELECTRICAL PARTS	
71	---	SEE E-7 IN ELECTRICAL PARTS	
71A	---	BRACKET, tape head mtg (part of 71)	
72	3S135441	SCREW, machine: 2-56 x 1/4 (head mtg)	.05
73	41A40180B01	SPRING	.05
75	3T43787A02	SCREW, special: 4-40 x 5/8 (azimuth adjust)	.85
76	43K471633	BEARING, ball: 3/32	.01
77	41B43778A01	SPRING, conical: head adjust screw	.10
78	3S6961	SCREW, mach: 4-40 x 3/4 (head tension adj)	.03

(Cont'd on Page 21)


ANT RECEPT
Q1 25B RF AMP
2µV @ 400~ FOR 1 WATT 1000KC
Q2 25A CONV
20µV @ 400~ (262.5KC) FOR 1 WATT
Q3 24B IF AMP
1.5KµV @ 400~ (262.5KC) FOR 1 WATT
T1
T2
E2 1N461
E1 1N461
L1
L2
L3
L1, L2 & L3 CONNECTIONS
(BOT VIEW)
C1 110 to 380
C2 330
C3A 65 NOM
C3B 65 NOM
C4 180
C7 250
C9 .01
C10 180
C12 160
C11 .0047
C13 .002
C14 .1
C15 10MF
C16 150
C17 .01
C6 2MF
C5 .01
C8 .01
R1 220
R2 220
R3 330
R4 82K
R5 68K
R6 27K
R7 3.3K
R8 2.2K
R9 6.8K
R10 4.7K
R11 33K
R12 100K
R13 220
R14 6.8K
R15 150K
R16 1.5K
R17 470
R20 470K
C18A 500MF
C18B 500MF
E5
SW ACTIVATED WITH CARTRIDGE PUSHED IN
E4
SOLENOID FOR DETENTING HEAD
Q16 2N176 REGULATOR
E6
NORMALLY OPEN SW ON VOL TONE SHAFT
CONTACTS FOR AUTOMATIC DETENTING
MOTOR E3
GOVERNOR CONTACTS ON MOTOR
E13
C51 .1
C52 1000MF
C53 .1
R18 220
R19 12
LEFT CHANNEL
RIGHT CHANNEL
E7A
E7B
15µV @ 400~ FOR 1 WATT
Q4 M822 1ST TAPE PRE AMP
Q5 M54 2ND TAPE PRE-AMP
Q6 M822 1ST TAPE PRE-AMP
Q7 M54 2ND TAPE PRE-AMP
C20 20MF
C21 20MF
C22 16MF
C23 16MF
C26 80 MF
C27 80MF
C28 .0047
C29 .0047
R21 47K
R22 47K
R23 180
R24 180
R25 47K
R26 47K
R27 1.5K
R28 1.5K
R29 100
R30 100
R31 1K
R32 1K
R33 8.2K
R34 8.2K
R35 22K
R36 22K
E9
FRONT VIEW TAPE HEAD CONN CABLE
RED ORG SHIELD YEL BLU
E8
R42 2.2K
R43 2.2K
.003V R.M.S. FOR 1 WATT @ 400~
R39 1K
R40 1K
R41 25K BAL
R44 1.5K
R45 1.5K
R46A 40K
R46B 40K
R46C 50K
R46D 50K
TONE
VOLUME
C32 5
C33 5
C34 .1
C35 .1
C36 22
C37 22
C38 2MF
C39 2MF
R48 1K
R49 1K
R50 220K
R52 220K
Q9 54C PRE-DRIVER
Q10 54C DRIVER
Q11 2N176 PWR AMP
Q13 54C PRE-DRIVER
Q14 54C DRIVER
Q15 2N176 PWR AMP
T3
T4
C40 .0015
C41 .0015
C42 22
C43 22
C44 80MF
C45 80MF
C46 .0015
C47 .0015
C48 1000MF
C49 .01
C50 1000MF
C54 .01
C55 .01
C30 32MF
C31 32MF
R51 15
R53 15
R54 5.6K
R55 5.6K
R56 39K
R57 39K
R58 2.2M
R59 2.2M
R60 1K
R61 1K
R62 220
R63 220
R64 100
R65 100
R66 220
R67 .2
R68 .2
R69 680
8Ω E11 FRONT SPKR LEFT CHANNEL
8Ω E12 REAR SPKR RIGHT CHANNEL
8Ω E15 A7MVF, VT ONLY
WHT BRN YEL BRN-YEL
L4
ON-OFF SW VOL. CONT
E14 7.5 AMP FUSE
BLK + 14.4V
E10 DIAL LIGHT
BLU DIAL LIGHT LEAD
C56 .01
DIAG -63D43301A31-OR-5PCL
E B C (BOT VIEW) TRANSISTOR CONN
(BOT VIEW) TRANSISTOR CONN
(BOT VIEW) C3 CONN
(BOT VIEW) T1 & T2 CONN
WIDE LUG
(BOT VIEW) Q11, 15 & 16 CONN

CAUTION

"A" LEAD MUST BE CONNECTED TO POSITIVE (+) SIDE OF POWER SUPPLY. RADIO WILL NOT OPERATE AND DAMAGE TO COMPONENTS WILL RESULT IF CONNECTED OTHERWISE.

NOTES:

CAPACITORS - UNLESS OTHERWISE SPECIFIED DECIMAL VALUES IN MF. ALL OTHERS IN MMF.
VOLTAGES - MEASURED FROM POINT INDICATED TO CHASSIS WITH A VTVM. ± 10% NO SIGNAL INPUT.

*THE EXACT VALUE TO BE DETERMINED BY PRODUCTION PROCESS. REPLACE WITH THE SAME VALUE OF THE ORIGINAL PART.

TUNING RANGE - 530 TO 1610KC
INPUT VOLTAGE - 14.4V DC
IF FREQ - 262.5KC

PLATED BOARD WIRING LEGEND

■■, ■ = B+ ▛ = RF AVC ▛▛ = IF AVC

SCHEMATIC DIAGRAM

truck radio MANUAL 68P43101A16

MOTOROLA U5MMT — MACK TRUCKS INC. 204SX28

U5MW — WHITE MOTOR CO. 891600

MOTOROLA

service manual

GENERAL INFORMATION

TYPE

Automotive type all-transistor superheterodyne AM radio for standard broadcast reception; operates from 12 volt negative or positive ground system (by changing a polarity reversing plug on the radio).

Model U5MMT is designed for installation in Mack trucks; Model U5MW is designed for installation in White Motor Co. trucks.

These receivers contain a plated chassis board, 6 transistors and 2 diodes.

WARRANTY SERVICE STATION PROCEDURE

1. A defective in-guarantee radio must be accompanied by the Customer's Guarantee Policy Tag. This tag must be properly filled in by the Mack or White Motor Truck dealer at the time of radio purchase. Accept as guarantee repairs only those radios within the guarantee period. The removal or re-installation of this receiver is customarily performed by the Mack or White Motors Truck dealer and is not covered by this guarantee. Also, the removal of motor noise, tire static, electrical interference, faulty installations and aerial repairs are not considered as guarantee repairs and, therefore, expenses related to such services should be handled by the car dealer.

2. Fill in Motorola Guarantee Labor Claim, Part Number 68P60016A30, and mail Green and Pink copies to:

Motorola Guarantee Service
Motorola Automotive Products, Inc.
9401 West Grand Avenue
Franklin Park, Illinois.

3. The yellow copy of the Motorola Guarantee Labor Claim is to be retained by the authorized service station for his files.

ALL TRANSISTOR
5½ 6 7 8 10 12 14 16
Mack

MODEL U5MMT

5½ 6 7 8 10 12 14 16
MOTOROLA

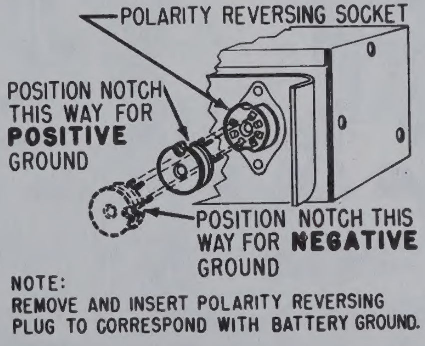
MODEL U5MW

4. Defective parts for guarantee repairs made on this model are to be sent to your Motorola Distributor for free replacement supported with the defective parts return tag or form which you are now using.

5. Only those service shops authorized by their Motorola Distributor can perform guarantee repairs on a no-charge basis to the customer. If you are not already authorized as a Motorola Auto Radio Service Station and you are interested in handling this service, please contact your Motorola Distributor for complete details.

SERVICE NOTES

1. Make certain the "A" lead is connected properly to power source, i.e., check position of polarity reversing plug, otherwise damage to receiver may result. If a battery eliminator is used as a power source in place of a battery, it must be well filtered and regulated.


POLARITY REVERSING SOCKET
POSITION NOTCH THIS WAY FOR **POSITIVE** GROUND
POSITION NOTCH THIS WAY FOR **NEGATIVE** GROUND

NOTE:
REMOVE AND INSERT POLARITY REVERSING PLUG TO CORRESPOND WITH BATTERY GROUND.

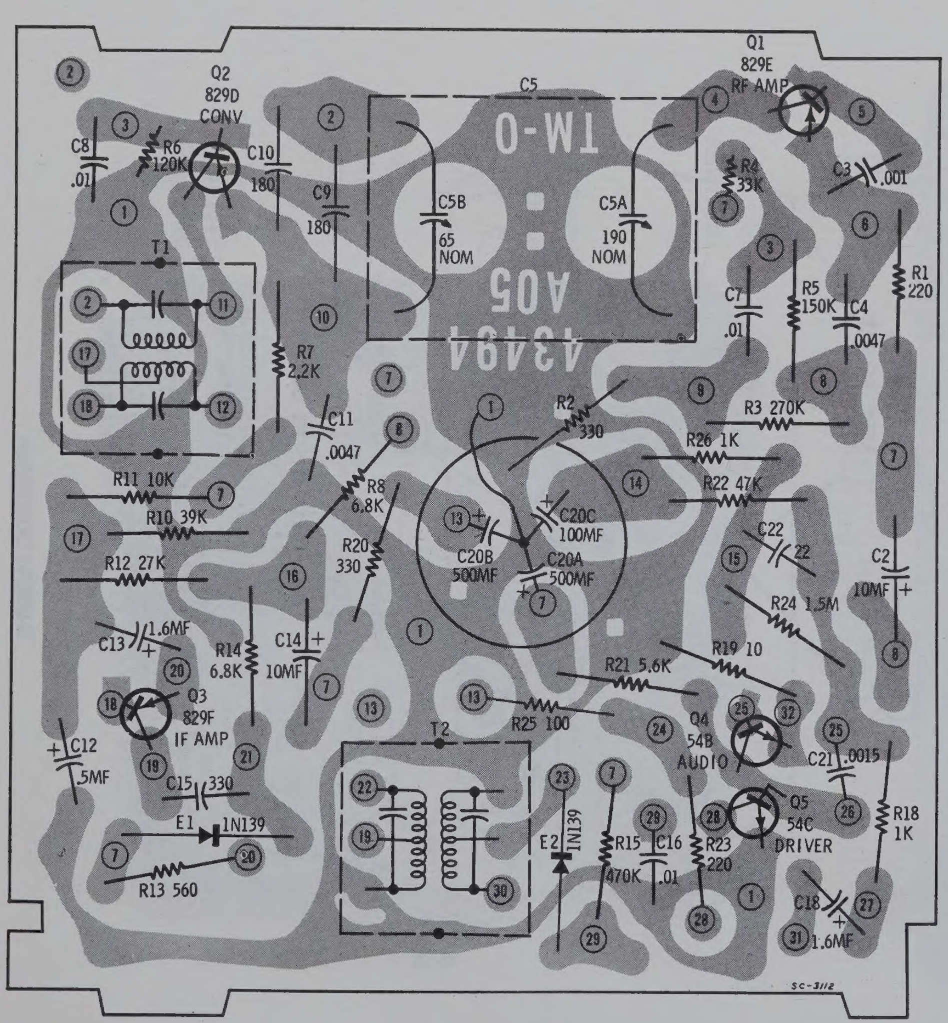
2. PLATED CHASSIS BOARD DESCRIPTION - Motorola's PLAcir chassis has plating on both sides of the chassis board. The exposed side contains the actual circuit connections while the plating on the component side of the chassis board provides a convenient chassis B- return for components and circuit wiring. Plating on the component side also provides shielding between the top and bottom of the unit similar to a metal chassis which incorporates hand wiring.

All B- connections are carried through the PLAcir chassis in multiple paths to the B- side. This insures a good low resistance return path. Two separate and independent paths are provided to ground.

3. TO SERVICE PLATED CHASSIS BOARD - To remove the plated chassis from the radio housing, first set the dial pointer to low end (540 Kc), then remove the dial scale and background. Release the two chassis locking spring clips and carefully lift chassis board out of housing (the lead lengths are long enough to permit this - see photo on next page). The chassis can now be serviced from top or bottom.

After servicing is performed, reinstall plated chassis board. Make

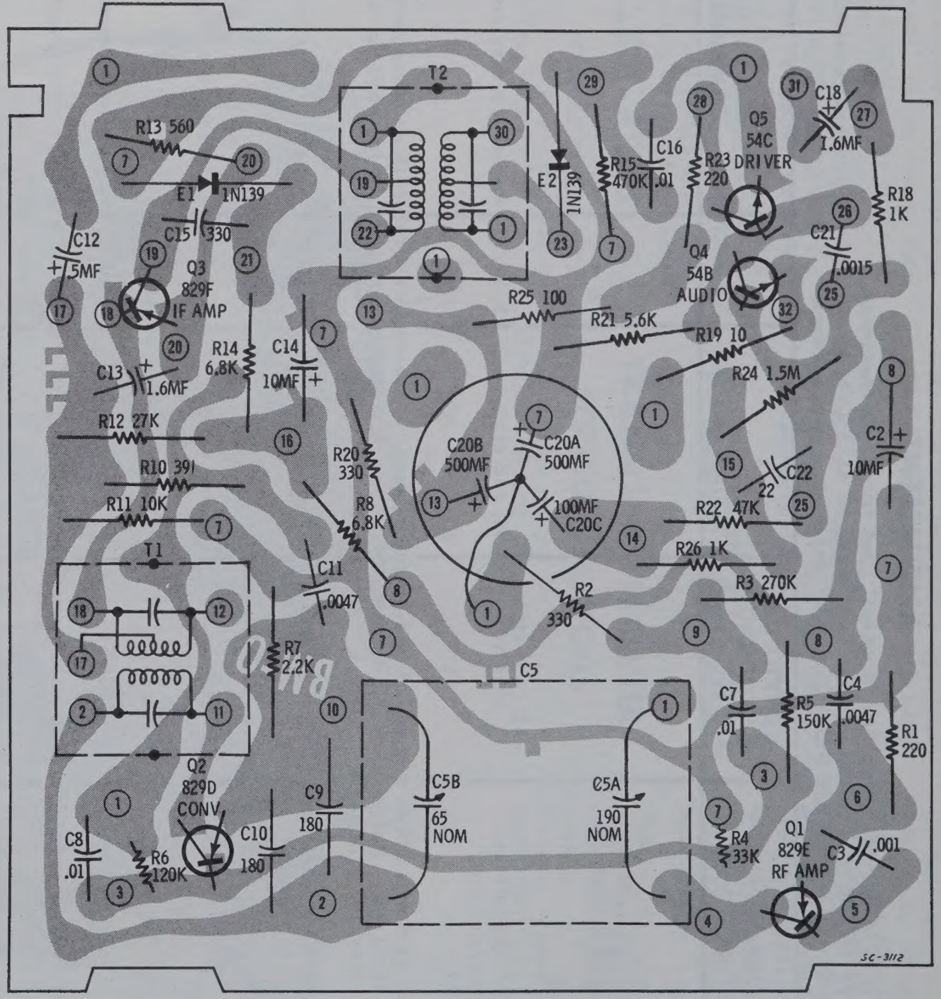
MOTOROLA INC. 9401 WEST GRAND AVENUE, FRANKLIN PARK, ILLINOIS
PART NO. 68P43101A16 3-67 PRICE 20 CENTS COPYRIGHT 1967 BY MOTOROLA INC. - PRINTED IN U.S.A.


C5
Q1
829E
RF AMP
Q2
829D
CONV
Q3
829F
IF AMP
Q4
54B
AUDIO
Q5
54C
DRIVER
T1
T2
C5A
190
NOM
C5B
65
NOM
TM-0
A05
43494
C8
.01
R6
120K
C10
180
C9
180
R7
2.2K
C11
.0047
R8
6.8K
R20
330
R2
330
C20A
500MF
C20B
500MF
C20C
100MF
R11 10K
R10 39K
R12 27K
C13
1.6MF
R14
6.8K
C14
10MF
C12
.5MF
C15
330
E1
1N139
R13 560
R25 100
R21 5.6K
R19 10
R24 1.5M
C22
22
R22 47K
R26 1K
R3 270K
C7
.01
R5
150K
C4
.0047
R4
33K
C3
.001
R1
220
C2
10MF
E2
1N139
R15
470K
C16
.01
R23
220
C21
.0015
R18
1K
C18
1.6MF
SC-3112

TOP VIEW

PLATED CHASSIS REFERENCE POINTS AND PARTS LOCATION

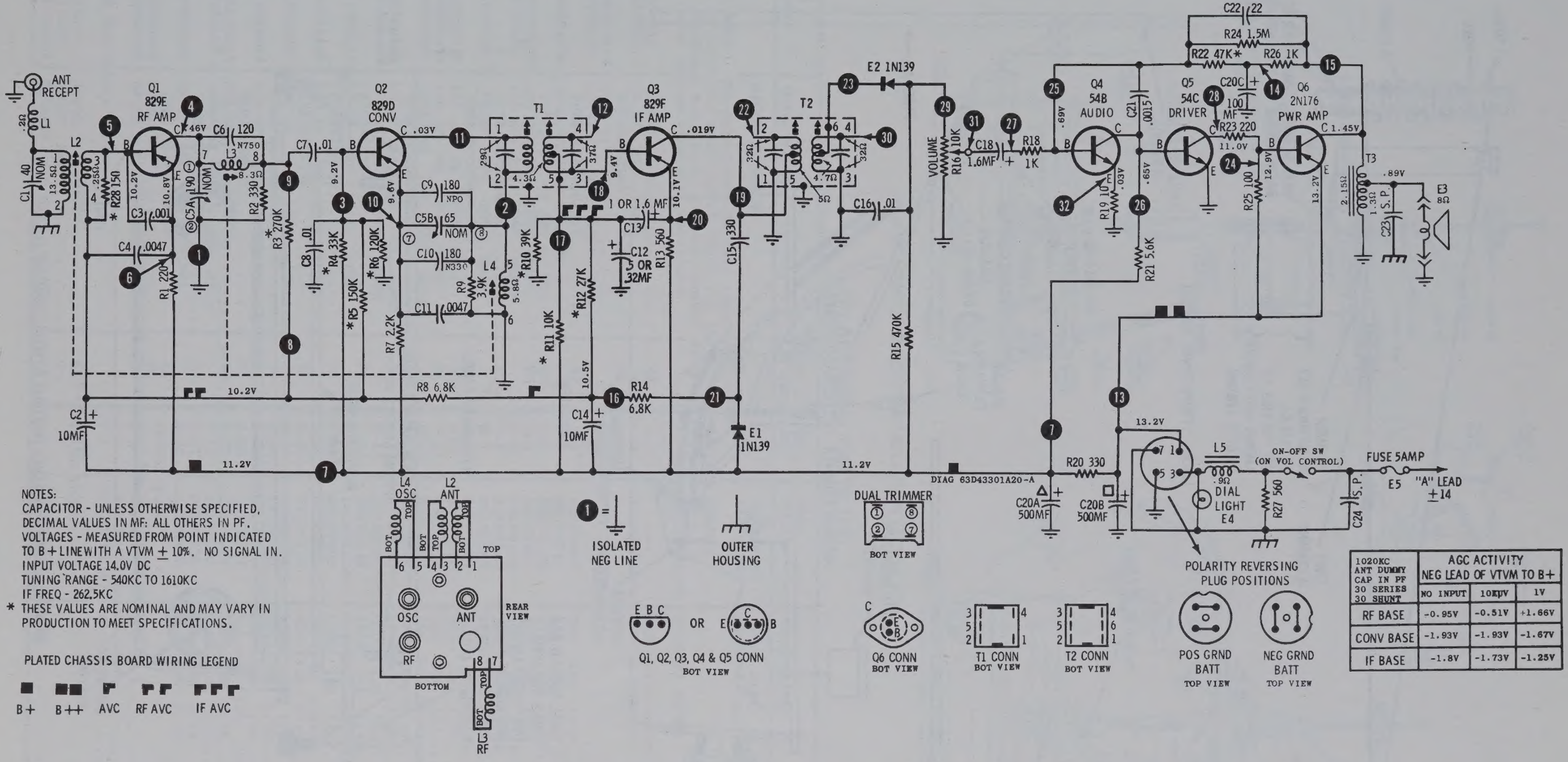
(VIEW FROM COMPONENT SIDE OF BOARD)


T2
T1
C5
Q1
829E
RF AMP
Q2
829D
CONV
Q3
829F
IF AMP
Q4
54B
AUDIO
Q5
54C
DRIVER
R13 560
E1
1N139
C15
330
C12
.5MF
C13
1.6MF
R14
6.8K
C14
10MF
R12 27K
R10 391
R11 10K
E2
1N139
R15
470K
C16
.01
R23
220
C18
1.6MF
R18
1K
C21
.0015
R25 100
R21 5.6K
R19 10
R24 1.5M
R20
330
R8
6.8K
C20A
500MF
C20B
500MF
C20C
100MF
C22
22
R22 47K
R26 1K
R3 270K
R2
330
C11
.0047
R7
2.2K
C2
10MF
C5B
65
NOM
C5A
190
NOM
C7
.01
R5
150K
C4
.0047
R1
220
C8
.01
R6
120K
C10
180
C9
180
R4
33K
C3
.001
SC-3112

BOTTOM VIEW

PLATED CHASSIS REFERENCE POINTS AND PARTS LOCATION

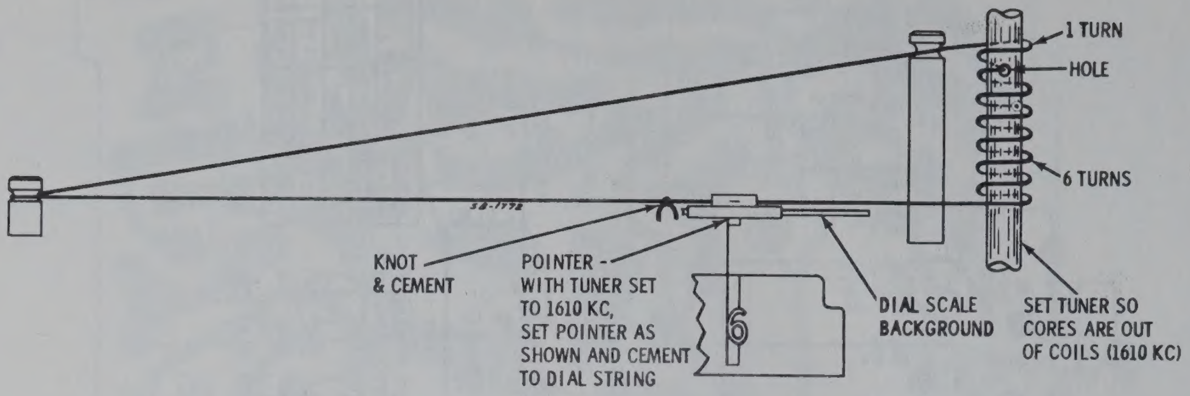
(VIEW FROM WIRING SIDE OF BOARD)


ANT RECEPT
L1 .2Ω
C1 40 NOM
13.5Ω
L2 .25Ω
Q1 829E RF AMP
R28 150
C3 .001
C4 .0047
R1 220
C6 120 N750
L3 8.3Ω
C5A 190 NOM
R2 330
C7 .01
R3 270K
C8 .01
R4 33K
R5 150K
R6 120K
R7 2.2K
Q2 829D CONV
C9 180 NPO
C5B 65 NOM
C10 180 N330
C11 .0047
R9 3.9K
L4 5.8Ω
T1 29Ω 4.3Ω 37Ω
R10 39K
R11 10K
R12 27K
Q3 829F IF AMP
C12 5 OR 32MF
C13 1 OR 1.6 MF
R13 560
R8 6.8K
R14 6.8K
C14 10MF
C2 10MF
10.2V
11.2V
10.5V
C15 330
E1 1N139
T2 32Ω 4.7Ω 5Ω 32Ω
E2 1N139
C16 .01
R15 470K
VOLUME R16 10K
C18 1.6MF
R18 1K
Q4 54B AUDIO
R19 10
C21 .0015
R21 5.6K
Q5 54C DRIVER
C20C 100 MF
R23 220
R22 47K
R24 1.5M
R26 1K
C22 22
R25 100
Q6 2N176 PWR AMP
T3 2.15Ω 1.3Ω
C23 S.P.
E3 8Ω
R20 330
C20A 500MF
C20B 500MF
DIAG 63D43301A20-A
13.2V
L5 .9Ω
DIAL LIGHT E4
R27 560
ON-OFF SW (ON VOL CONTROL)
C24 S.P.
FUSE 5AMP
E5
"A" LEAD +14
POLARITY REVERSING PLUG POSITIONS
POS GRND BATT TOP VIEW
NEG GRND BATT TOP VIEW
DUAL TRIMMER BOT VIEW
ISOLATED NEG LINE
OUTER HOUSING
L4 OSC
L2 ANT
L3 RF
TOP
BOT
REAR VIEW
OSC
ANT
RF
BOTTOM
E B C
OR
Q1, Q2, Q3, Q4 & Q5 CONN BOT VIEW
Q6 CONN BOT VIEW
T1 CONN BOT VIEW
T2 CONN BOT VIEW
PLATED CHASSIS BOARD WIRING LEGEND
B+
B++
AVC
RF AVC
IF AVC

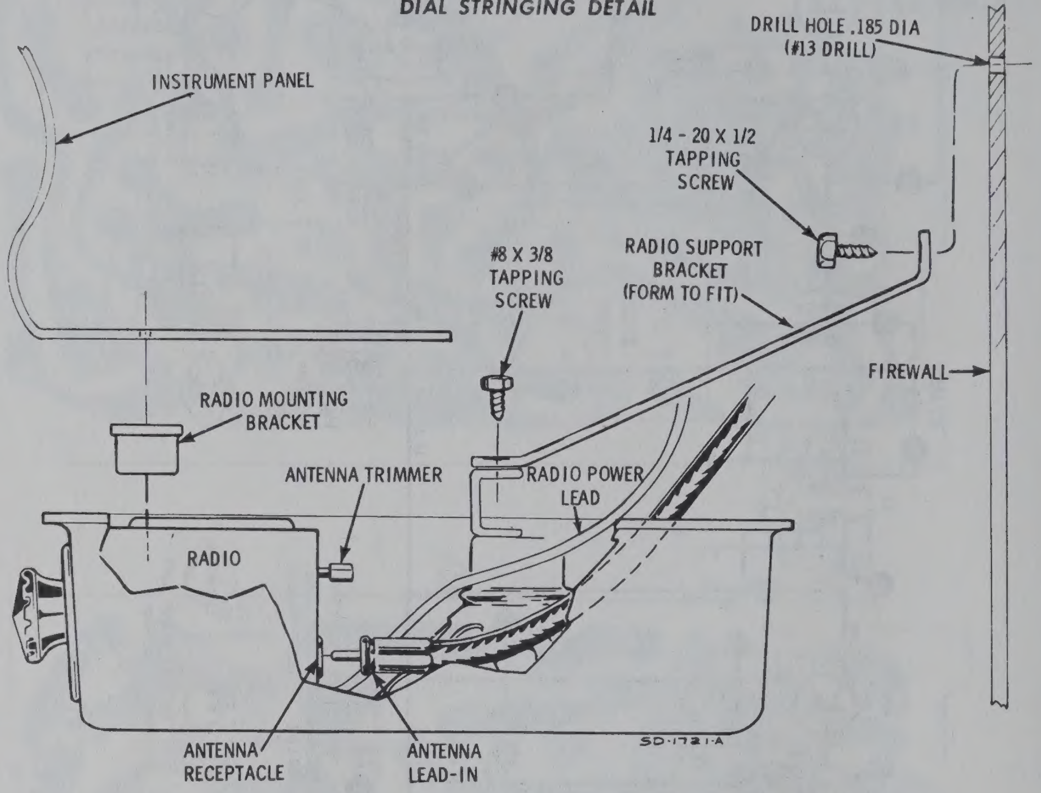
NOTES:
CAPACITOR - UNLESS OTHERWISE SPECIFIED, DECIMAL VALUES IN MF: ALL OTHERS IN PF.
VOLTAGES - MEASURED FROM POINT INDICATED TO B + LINE WITH A VTVM ± 10%. NO SIGNAL IN.
INPUT VOLTAGE 14.0V DC
TUNING RANGE - 540KC TO 1610KC
IF FREQ - 262.5KC
* THESE VALUES ARE NOMINAL AND MAY VARY IN PRODUCTION TO MEET SPECIFICATIONS.

1020KC ANT DUMMY CAP IN PF 30 SERIES 30 SHUNT	AGC ACTIVITY NEG LEAD OF VTVM TO B+		
	NO INPUT	10μV	1V
RF BASE	-0.95V	-0.51V	+1.66V
CONV BASE	-1.93V	-1.93V	-1.67V
IF BASE	-1.8V	-1.73V	-1.25V

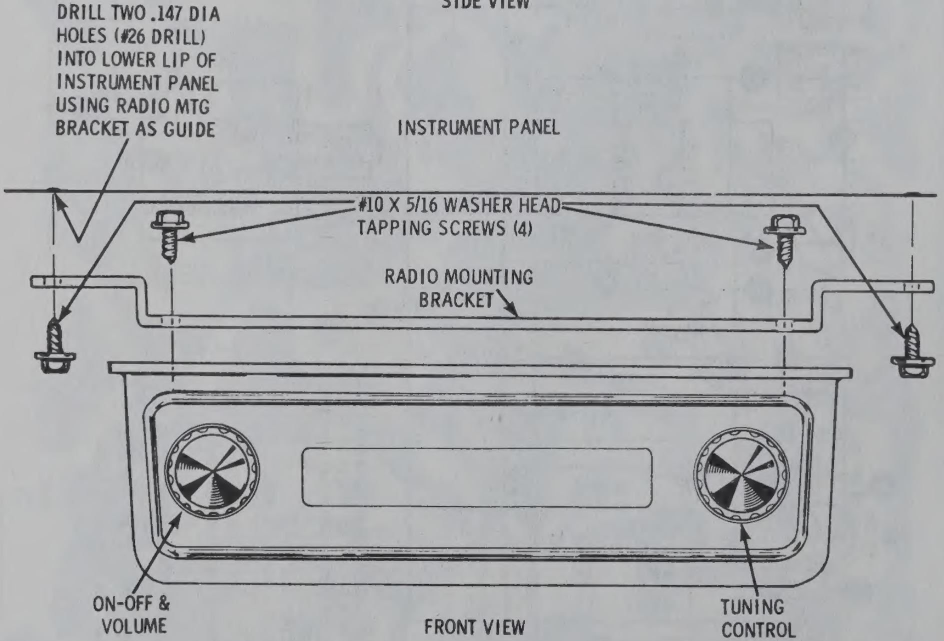
SCHEMATIC DIAGRAM


1 TURN
HOLE
6 TURNS
SB-1772
KNOT & CEMENT
POINTER - WITH TUNER SET TO 1610 KC, SET POINTER AS SHOWN AND CEMENT TO DIAL STRING
6
DIAL SCALE BACKGROUND
SET TUNER SO CORES ARE OUT OF COILS (1610 KC)

DIAL STRINGING DETAIL

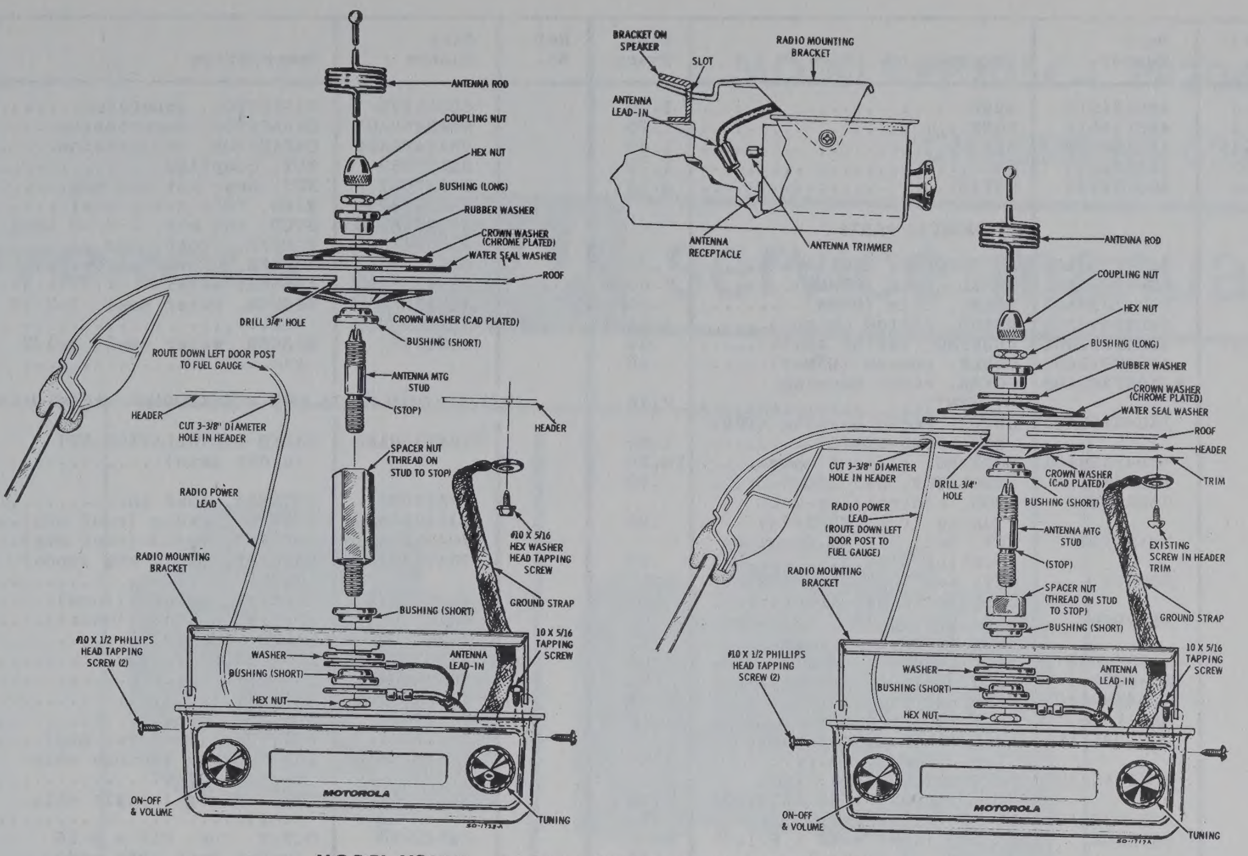

DRILL HOLE .185 DIA (#13 DRILL)
INSTRUMENT PANEL
1/4 - 20 X 1/2 TAPPING SCREW
RADIO SUPPORT BRACKET (FORM TO FIT)
#8 X 3/8 TAPPING SCREW
FIREWALL
RADIO MOUNTING BRACKET
ANTENNA TRIMMER
RADIO POWER LEAD
RADIO
SD-1721-A
ANTENNA RECEPTACLE
ANTENNA LEAD-IN

SIDE VIEW


DRILL TWO .147 DIA HOLES (#26 DRILL) INTO LOWER LIP OF INSTRUMENT PANEL USING RADIO MTG BRACKET AS GUIDE
INSTRUMENT PANEL
#10 X 5/16 WASHER HEAD TAPPING SCREWS (4)
RADIO MOUNTING BRACKET
ON-OFF & VOLUME
TUNING CONTROL

FRONT VIEW

MODEL U5MW - RADIO INSTALLATION (UNDER DASH)


ANTENNA ROD
COUPLING NUT
HEX NUT
BUSHING (LONG)
RUBBER WASHER
CROWN WASHER (CHROME PLATED)
WATER SEAL WASHER
ROOF
DRILL 3/4" HOLE
CROWN WASHER (CAD PLATED)
BUSHING (SHORT)
ROUTE DOWN LEFT DOOR POST TO FUEL GAUGE
ANTENNA MTG STUD
(STOP)
HEADER
CUT 3-3/8" DIAMETER HOLE IN HEADER
HEADER
SPACER NUT (THREAD ON STUD TO STOP)
RADIO POWER LEAD
#10 X 5/16 HEX WASHER HEAD TAPPING SCREW
RADIO MOUNTING BRACKET
BUSHING (SHORT)
GROUND STRAP
#10 X 1/2 PHILLIPS HEAD TAPPING SCREW (2)
10 X 5/16 TAPPING SCREW
WASHER
BUSHING (SHORT)
ANTENNA LEAD-IN
HEX NUT
MOTOROLA
ON-OFF & VOLUME
TUNING
BRACKET ON SPEAKER
SLOT
RADIO MOUNTING BRACKET
ANTENNA LEAD-IN
ANTENNA RECEPTACLE
ANTENNA TRIMMER
ANTENNA ROD
COUPLING NUT
HEX NUT
BUSHING (LONG)
RUBBER WASHER
CROWN WASHER (CHROME PLATED)
WATER SEAL WASHER
ROOF
HEADER
TRIM
CUT 3-3/8" DIAMETER HOLE IN HEADER
DRILL 3/4" HOLE
CROWN WASHER (CAD PLATED)
BUSHING (SHORT)
RADIO POWER LEAD (ROUTE DOWN LEFT DOOR POST TO FUEL GAUGE)
ANTENNA MTG STUD
EXISTING SCREW IN HEADER TRIM
(STOP)
RADIO MOUNTING BRACKET
SPACER NUT (THREAD ON STUD TO STOP)
GROUND STRAP
BUSHING (SHORT)
#10 X 1/2 PHILLIPS HEAD TAPPING SCREW (2)
10 X 5/16 TAPPING SCREW
WASHER
BUSHING (SHORT)
ANTENNA LEAD-IN
HEX NUT
MOTOROLA
ON-OFF & VOLUME
TUNING

MODEL U5MW - RADIO INSTALLATION (ROOF TOP)

REPLACEMENT PARTS LIST

Ref. No.	Part Number	Description	List Price
		ELECTRICAL PARTS	
CAPACITORS - NOTE:		The capacitors in this list are recommended replacement types for the original equipment; all are ceramic disc type unless otherwise specified.	
C-1	20K534810	TRIMMER 5 to 80 pf.........	.45
C-2	23C41928A17	10 mf 25V lytic (USE 23D65282A21)..............	.95
C-3	21D40339A94	.001 mf 100V.............	
C-4	8C42750A20	.0047 mf 10% 100V mylar (USE 8C40906A27)..........	.30
C-5	*20C40254A16	DUAL TRIMMER C-5B 30 to 150 pf; C-5A 150 to 260 pf	1.40
C-6	21D40536A69	120 pf 10% 100V N750....	.20
C-7	8C42750A23	.01 mf 10% 100V mylar (USE 8C40906A30)..........	.30
C-8	8C42750A23	.01 mf 10% 100V mylar (USE 8C40906A30)..........	.30
C-9	21C40367A11	180 pf 5% 100V MICA.....	.30
C-10	21D40536A48	180 pf 5% 100V N330.....	.25
C-11	8C42750A20	.0047 mf 10% 100V mylar (USE 8C40906A27)..........	.30
C-12	23C43280A21	.5 mf +40-20% 15V lytic.	.30
C-13	23C41928A09	1.6 mf 25V lytic (USE 23C41928A05)..............	.90
C-14	23C41928A17	10 mf 25V lytic (USE 23D65282A21)..............	.95
C-15	21D40339A70	330 pf 10% 100V (USE 21K752589)................	.25
C-16	8C42750A23	.01 mf 10% 100V mylar (USE 8C40906A30)..........	.30
C-18	23C41928A09	1.6 mf 25V lytic (USE 23D41928A05)..............	.90
C-20	23C40302A04	500-500-100/16V lytic.....	3.40
C-21	8C42750A01	.0015 mf 20% 100V mylar (USE 8C40906A29)..........	.30
C-22	21D40536A50	22 pf 10% 100V N150 (USE 21R120539)...........	.25
C-23	64A41668A03	SPARK PLATE...............	.05
C-24	64A41668A03	SPARK PLATE...............	.05
MISCELLANEOUS ELECTRICAL PARTS			
E-1	48C134587	DIODE, 1N139..............	.65
E-2	48C134587	DIODE, 1N139..............	.65
E-3	50C41743A01	SPEAKER, 4 x 6 PM: 8Ω VC...	6.75
E-4	65R538410	BULB, dial: 14.4V - .11A...	.35
E-5	65R122345	FUSE, 5 amp...............	.10
COILS & CHOKES			
L-1	24C40788A04	ANTENNA CHOKE.............	.05
L-2,L-3 L-4	---	SEE TUNER PARTS	
L-5	25C41871A06	CHOKE, filter.............	1.30
RESISTORS & CONTROLS			
R-1	6S127800	220 10% 1/4W.............	.17
R-2	6S129775	330 10% 1/4W.............	.17
R-3	6S129148	270K 10% 1/4W............	.17
R-4	6S127632	33K 10% 1/2W.............	.17
R-5	6S129146	150K 10% 1/4W............	.17
R-6	6S127540	120K 10% 1/2W............	.17
R-7	6S128689	2200 10% 1/4W............	.17
R-8	6S128687	6800 10% 1/4W............	.17
R-9	6S129819	3900 5% 1/4W.............	.33
R-10	6S128903	39K 10% 1/4W.............	.17
R-11	6S129225	10K 10% 1/4W.............	.17
R-12	6S127806	27K 10% 1/4W.............	
R-13	6S129620	560 10% 1/4W.............	.17
R-14	6S128687	6800 10% 1/4W............	.17
R-15	6S129148	470K 10% 1/4W............	.17
R-16	18C42352A01	CONTROL, vol & sw..........	2.25
R-18	6S127802	1000 10% 1/4W............	.17
R-19	6S129755	10 10% 1/4W..............	.17
R-20	6S129775	330 10% 1/4W.............	.17
R-21	6S129433	5600 10% 1/4W............	.17
R-22	6S128902	47K 10% 1/4W.............	.17
R-23	6S127800	220 10% 1/4W.............	.17
R-24	6S129014	1.5 meg 10% 1/4W.........	.17
R-25	6S129753	100 10% 1/4W.............	.17
R-26	6S127802	1000 10% 1/4W............	.17
R-27	6S122802	560 10% 1/2W.............	.17
R-28	6S129862	150 10% 1/4W.............	
TRANSFORMERS			
T-1	24D42517A23	IF, 1st..................	1.75
T-2	24D42517A26	IF, 2nd..................	1.85
T-3	*25D43922A03	OUTPUT...................	1.75
TRANSISTORS			
Q-1	48S134914	829E.....................	1.75

Ref. No.	Part Number	Description	List Price
Q-2	48S134913	829D......................	1.75
Q-3	48S134915	829F......................	1.75
Q-4	48S134809	54B.......................	1.30
Q-5	48S134810	54C.......................	1.75
Q-6	48S134747	2N176.....................	4.15

MECHANICAL PARTS

Ref. No.	Part Number	Description	List Price
	64B42293A04	BACKGROUND, dial scale.....	.65
	13B42638A01	BEZEL, trim (U5MMT)........	.85
	13B42326A01	BEZEL, trim (U5MW).........	.85
	84D43494A05	BOARD, plated chassis......	1.15
	43A42321A01	BUSHING, tuning shaft......	.50
	30A42912A01	CABLE, ground (U5MMT)......	.40
	*15C42290A08	COVER, radio housing (U5MMT).................	2.15
	15C42290A03	COVER, radio housing (U5MW USE 15C42990A01)..........	1.25
	15D42358A01	HOUSING, radio & spkr......	10.20
	14A543810	INSULATOR, pwr trans.......	.10
	36B512985	KNOB, control: sw-vol-tuning (USE 1V538924).....	.95
	2S132707	NUT, hex: 3/8-32 (cont & bushing mtg).............	.20
	2S1376	NUT, hex: 3/8-32 x 1/2 (radio to hsg front)......	.03
	2S129892	NUT, hex: 8-32 x 5/16 (spkr mtg to hsg)..............	.05
	75K544502	PAD, cushion: bezel........	.05
	28A542751	PLUG, polarity revr........	.25
	52B42386A01	POINTER, dial..............	.55
	9A531066	RECEPTACLE, antenna........	.15
	9C41095A18	RECEPTACLE, fuse: incl fuse (U5MMT).............	1.55
	9C41095A13	RECEPTACLE, fuse: incl fuse (U5MW - USE 9K564324)	.90
	34B42361A01	SCALE, dial................	.70
	3S122021	SCREW, mach: 8-32 x 9/16 (spkr mtg to hsg).........	.05
	3A42461A01	SCREW, spcl: #8-15 x 3/4 (chassis mtg to hsg)......	.10
	3K560695	SCREW, tpg: #6 x 1/2 (trans mtg).....................	.03
	9K544848	SOCKET, dial light (USE 9K544543)................	.25
	*9B42387A01	SOCKET, polarity rcvr......	.30
	9C43089A01	SOCKET, trans: pwr.........	.25
	46K565260	STUD, trimount.............	.05

INSTALLATION PARTS AND ACCESSORIES - MODEL U5MMT

Ref. No.	Part Number	Description	List Price
	*1V43600A36	ANTENNA MTG & SUPPRESSION KIT......................	13.80
	85A42053A01	ANTENNA ROD: less lead-in..	1.80
	7C42357A04	BRACKET, radio mtg.........	1.45
	43A537670	BUSHING, nylon: long.......	.15
	43K537671	BUSHING, nylon: short......	.15
	1B537693	CABLE, ant lead-in.........	2.65

Ref. No.	Part Number	Description	
	8B561974	CAPACITOR, generator.......	.75
	8B42460A01	CAPACITOR, suppression.....	1.10
	8B42460A02	CAPACITOR, suppression.....	1.10
	2A537682	NUT, coupling..............	.65
	2A537687	NUT, hex: ant rod mtg......	.15
	42A537679	RING, "O": water seal......	.20
	46B43486A01	STUD, ant mtg: 3-3/16 long.	1.65
	4K565273	WASHER, crown: cad pl......	.60
	4A537675	WASHER, crown: chrome pl...	1.85
	4A44178A03	WASHER, metal..............	.20
	4A537680	WASHER, water seal: 1-3/16 dia......................	.15
	4A537681	WASHER, water seal: 3-1/2 dia......................	.40

INSTALLATION PARTS AND ACCESSORIES - MODEL U5MW

Ref. No.	Part Number	Description	
	*1V42300A60	RADIO INSTALLATION KIT (under dash).............	4.00
	1B537693	ANTENNA, lead-in...........	2.65
	85A42053A01	ANTENNA, radio (roof mtg)..	1.80
	7C42357A01	BRACKET, radio (roof mtg)..	1.45
	7B42433A01	BRACKET, radio mtg (under dash)....................	1.15
	43A537670	BUSHING, nylon: (long).....	.15
	43A537671	BUSHING, nylon: (short)....	.15
	30K542674	CABLE, ground..............	.30
	8B561974	CAPACITOR..................	.75
	8B42460A01	CAPACITOR..................	1.10
	8B42460A02	CAPACITOR..................	1.10
	2A537682	NUT, coupling..............	.65
	2A537687	NUT, hex (roof ant mtg)....	.15
	43A42436A01	NUT, spacer (double skin roof)....................	2.45
	2A42435A01	NUT, spacer (single skin roof)....................	.85
	3K565275	SCREW, tpg: #10 x 5/16 (under dash brkt mtg).....	.03
	42K565270	STRAP, radio mtg (under dash)....................	.30
	46A42434A01	STUD, antenna mtg..........	1.35
	4A537675	WASHER, crown..............	1.85
	4A44178A03	WASHER, flat (roof mtg ant)	.20
	4A537680	WASHER, water seal.........	.15
	4A537681	WASHER, water seal.........	.40

TUNER PARTS

Ref. No.	Part Number	Description	
	*77D42322A02	TUNER, MT581: complete.....	12.45
	*1V43800A55	COILS & MTG PLATE ASSEM: incl L-2,L-3,L-4..........	2.60
	76C40706A06	CORE, tuning: ant & RF.....	.55
	76C40647A04	CORE, tuning: osc..........	.35
	47C40648A10	SHAFT, tuning..............	.60
	41B40650A01	SPRING, shaft ret..........	.05
	4K721821	WASHER, "C": (tuning shaft)	.03

*DENOTES NEW ITEM APPEARING IN ANY LIST FOR FIRST TIME.

MODELS PP205C-1, PP206C-1

CHASSIS HS-63230

MOTOROLA service manual

MODEL PP205C-1

MODEL PP206C-1

ELECTRICAL SPECIFICATIONS

Power Supply: 120 volts, 60 cycle AC only.

Power Consumption: 35 watts.

RELATED PUBLICATIONS REFERENCE

Model PP205C-1	M115RC
Model PP206C-1	M116RC

SERVICE NOTES

LINE CORD REVERSAL - For minimum hum, insert line cord plug in both positions. Leave in the position that provides minimum hum.

OPERATING AMPLIFIER WITH LOAD - Always operate the amplifier with an output load (either the speakers or an 8 ohm, 5 watt resistive load) across each channel.

SPEAKER PHASING - Refer to the schematic diagram.

RECORD CHANGER REMOVAL

1. Open changer drawer to operating position.

2. Screw changer hold down screws (clockwise) fully into record changer base.

3. Remove metal plug from right side wall of record changer compartment. Insert a screw driver in the hole and position retaining clip in a vertical plane.

4. Lift right side of changer up and position the other retaining clip in a vertical plane.

5. Lift up changer and disconnect audio and power cables from changer base plate.

CHASSIS REMOVAL

1. From rear of cabinet, remove four (4) screws along rear of handle and four (4) screws across cabinet back and screw in band on back. Remove speakers from cabinet.

2. Remove three (3) control knobs. Carefully pull cabinet front forward and remove three (3) screws which secure chassis to cabinet front.

3. If necessary, disconnect all cables (speakers, etc.).

MOTOROLA INC. 9401 WEST GRAND AVENUE, FRANKLIN PARK, ILLINOIS
PART NO. 68P63010A72 2-67 PRICE 15 CENTS COPYRIGHT 1967 BY MOTOROLA INC. - PRINTED IN U.S.A.

STYLUS REPLACEMENT

To Remove Stylus

1. Lift tone arm to a vertical position.

2. Rotate the stylus selector to the 78 RPM position.

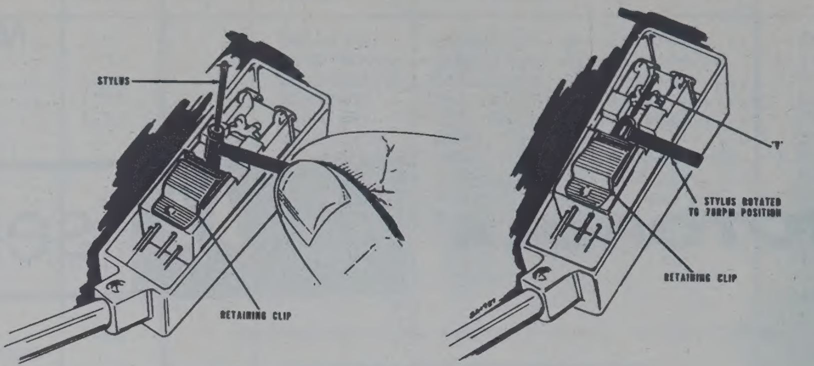
3. Grasp stylus with fingers and with a gentle motion twist stylus so the tip end raises and the rear portion snaps out from under the retaining clip.

To Replace Stylus

1. Lift tone arm to a vertical position.

2. Holding new stylus in position with fingers, snap rear portion of stylus under the retaining clip.

3. Be sure stylus rests in "V" of cartridge; then return tone arm to normal position.

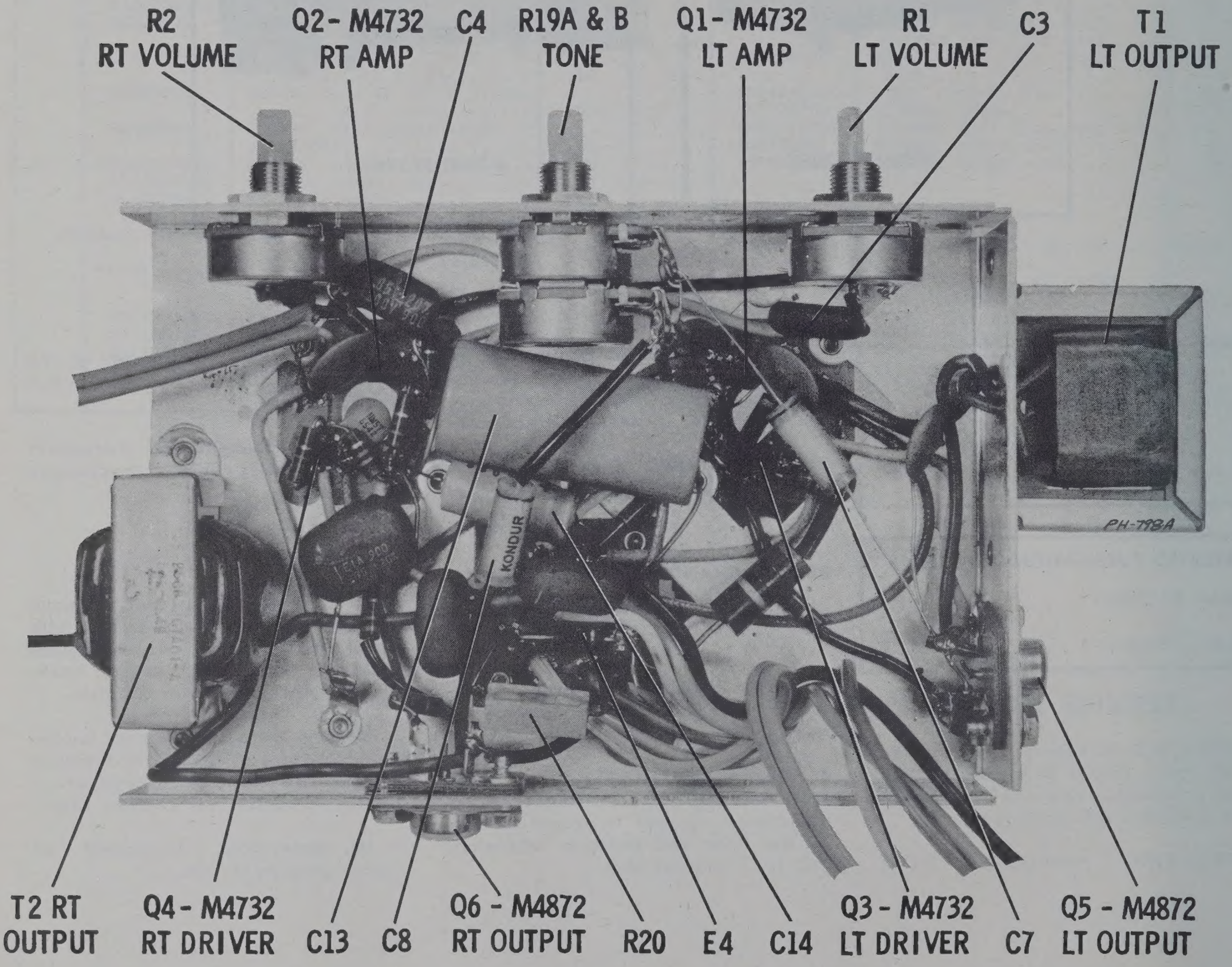

STYLUS
RETAINING CLIP
"V"
STYLUS ROTATED TO 78RPM POSITION
RETAINING CLIP

STYLUS REPLACEMENT

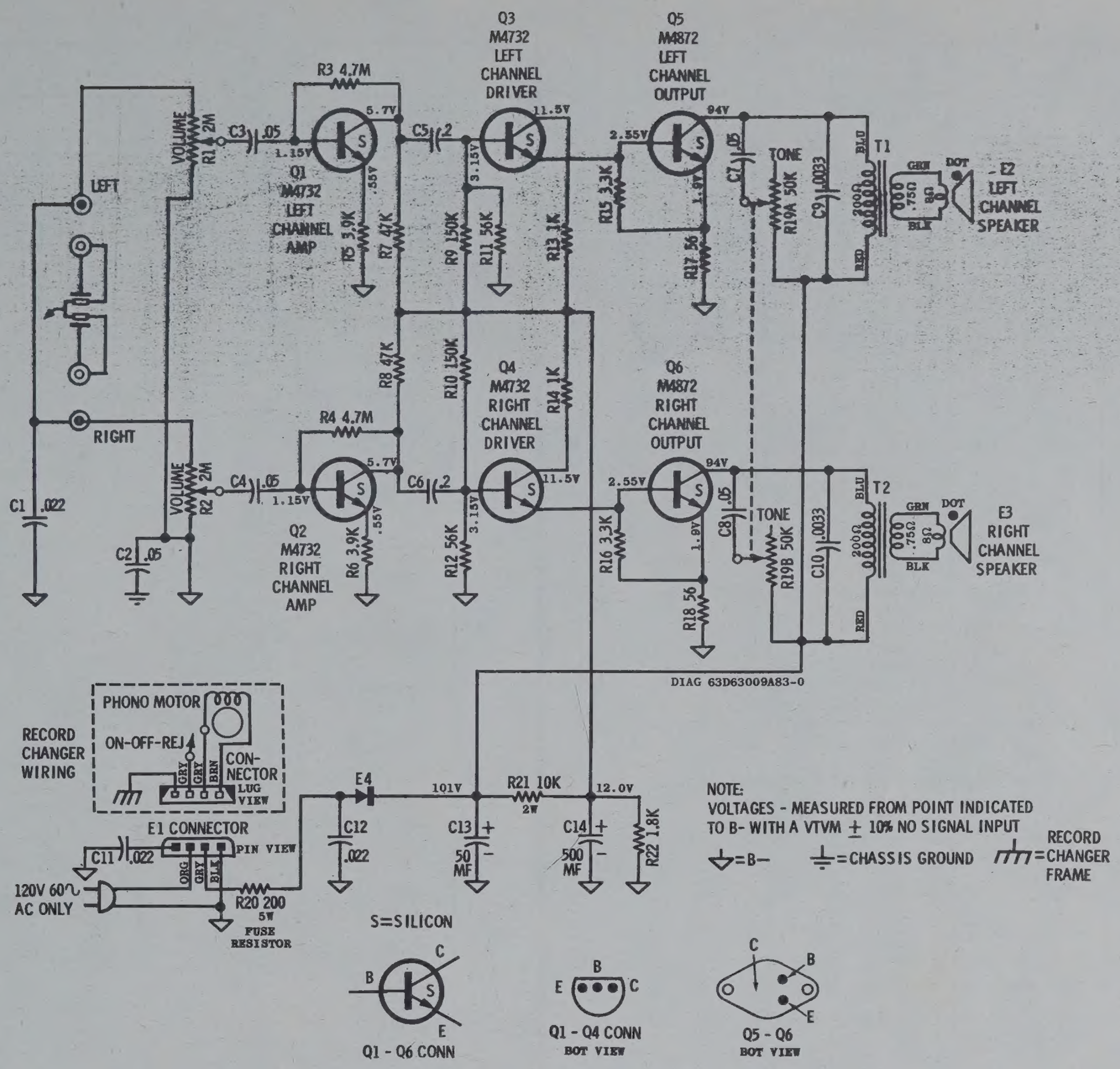
CARTRIDGE REPLACEMENT

1. Remove two (2) screws holding cartridge.

2. Unplug cartridge from leads at rear of cartridge.


R2
RT VOLUME
Q2 - M4732
RT AMP
C4
R19A & B
TONE
Q1 - M4732
LT AMP
R1
LT VOLUME
C3
T1
LT OUTPUT
PH-79BA
KONDUR
T2 RT
OUTPUT
Q4 - M4732
RT DRIVER
C13
C8
Q6 - M4872
RT OUTPUT
R20
E4
C14
Q3 - M4732
LT DRIVER
C7
Q5 - M4872
LT OUTPUT

PARTS LOCATION


Q3
M4732
LEFT
CHANNEL
DRIVER
Q5
M4872
LEFT
CHANNEL
OUTPUT
R3 4.7M
VOLUME
R1 2M
C3 .05
1.15V
5.7V
.55V
Q1
M4732
LEFT
CHANNEL
AMP
C5 .2
11.5V
3.15V
2.55V
94V
1.9V
C7 .05
TONE
R19A 50K
C9 .0033
T1
BLU
GRN
DOT
.75Ω
8Ω
200Ω
BLK
RED
E2
LEFT
CHANNEL
SPEAKER
LEFT
RIGHT
R5 3.9K
R7 47K
R9 150K
R11 56K
R13 1K
R15 3.3K
R17 56
R8 47K
R10 150K
Q4
M4732
RIGHT
CHANNEL
DRIVER
R14 1K
Q6
M4872
RIGHT
CHANNEL
OUTPUT
R4 4.7M
VOLUME
R2 2M
C4 .05
1.15V
5.7V
.55V
C6 .2
11.5V
3.15V
2.55V
94V
1.9V
C8 .05
TONE
R19B 50K
C10 .0033
T2
E3
RIGHT
CHANNEL
SPEAKER
C1 .022
C2 .05
Q2
M4732
RIGHT
CHANNEL
AMP
R6 3.9K
R12 56K
R16 3.3K
R18 56
DIAG 63D63009A83-0
RECORD
CHANGER
WIRING
PHONO MOTOR
ON-OFF-REJ
GRY
GRY
BRN
CON-
NECTOR
LUG
VIEW
E1 CONNECTOR
PIN VIEW
ORG
GRY
BLK
C11 .022
120V 60~
AC ONLY
R20 200
5W
FUSE
RESISTOR
E4
C12 .022
101V
R21 10K
2W
12.0V
C13 50 MF
C14 500 MF
R22 1.8K
NOTE:
VOLTAGES - MEASURED FROM POINT INDICATED
TO B- WITH A VTVM ± 10% NO SIGNAL INPUT
=B-
=CHASSIS GROUND
=RECORD CHANGER FRAME
S=SILICON
B
C
E
S
Q1 - Q6 CONN
E B C
Q1 - Q4 CONN
BOT VIEW
C
B
E
Q5 - Q6
BOT VIEW

SCHEMATIC DIAGRAM

REPLACEMENT PARTS LIST

Ref. No.	Part Number	Description
		ELECTRICAL PARTS
CAPACITORS - NOTE:		The capacitors in this list are recommended replacement types for the original equipment; all are ceramic disc type unless otherwise specified.
C-1	8S132423	.022 mf +0-20% 400V mylar (USE 8K131588)
C-2	8S128690	.05 mf 20% 400V mylar
C-3	8S134372	.05 mf 20% 125V mylar (USE 8S129455)
C-4	8S134372	.05 mf 20% 125V mylar (USE 8S129455)
C-5	21D62461A05	.2 mf 10% 10V (USE 21R10003A08)
C-6	21D62461A05	.2 mf 10% 10V (USE 21R10003A08)
C-7	8S129455	.05 mf 20% 200V mylar
C-8	8S129455	.05 mf 20% 200V mylar
C-9	21K127855	.0033 mf 10% 500V (USE 21K746523)
C-10	21K127855	.0033 mf 10% 500V (USE 21K746523)
C-11	8S132423	.022 mf +0-20% 400V mylar (USE 8K131588)
C-12	8S132423	.022 mf +0-20% 400V mylar (USE 8K131588)
C-13	23C65808A08	50 mf 150V lytic
C-14	23C62914A04	500 mf 20V lytic
MISCELLANEOUS ELECTRICAL PARTS		
R-21	*65B60446B01	FUSE, resistor

Ref. No.	Part Number	Description
E-1	28A647033	PLUG, 4-conn: less contacts (phono pwr)
E-4	48S191A05	RECTIFIER, silicon
CONTROLS		
R-1	18D60116A52	CONTROL, volume
R-2	18D60116A52	CONTROL, volume
R-24 A & B	18D60116A84	CONTROL, tone
TRANSFORMERS		
T-1	*25C63503A07	OUTPUT
T-2	25C63503A07	OUTPUT
TRANSISTORS		
Q-1	48S134732	M4732
Q-2	48S134732	M4732
Q-3	48S134732	M4732
Q-4	48S134732	M4732
Q-5	48S134872	M4872
Q-6	48S134872	M4872
		MECHANICAL PARTS
	*30D63525A06	CABLE, twin cable: phono; 28" gray (incl .022 mf cap)
	39A749927	CONTACT, plug: use w/28A647033 plug
	30S189A03	CORD, AD line (USE 30S189A02)
	14A63948A01	INSULATOR, trans
	2S7051	NUT, hex: 3/8-32 (cont mtg)
	3S131448	SCREW, tpg: #6 x 3/8 (trans mtg)
	9B63949A01	SOCKET, trans mtg

Ref. No.	Part Number	Description
		CABINET PARTS
MODEL PP205C-1 SERIES		
	*15P63023A61	BAFFLEBOARD ASSEM: incl brkt & cord ret (LH)
	*15P63023A60	BAFFLEBOARD ASSEM: incl brkt & cord ret (RH)
	*16E60280B01	BOARD, chgr mtg: plastic
	7B63644A01	BRACKET, spkr mtg
	7B60072B01	BRACKET, spring locking: baffle board
	75B63642A01	BUMPER, plastic: chgr hsg stop
	38S10220A02	BUTTON, plug: chgr hsg
	16P63023A66	CABINET, portable: incl cable channels, bumpers & locking studs; char brn (PP205CE-1)
	16P63023A62	CABINET, portable: incl cable channels, bumpers & locking studs; blu (PP205CL-1)
	16P63023A64	CABINET, portable: incl cable channels, bumpers & locking studs; beige (PP205CN-1)
	42A63840A01	CATCH, rec chgr hsg: escut assem
	7B63593A04	CHANNEL, cable: cab assem: char brn (PP205CE-1)
	7B63593A09	CHANNEL, cable: cab assem: blu (PP205CL-1)
	7B63593A06	CHANNEL, cable: cab assem: beige (PP205CN-1)
	42A63585A01	CLIP, spindle: 45 RPM
	9A60992A01	CONNECTOR, plastic: spkr leads
	13P63023A67	ESCUTCHEON & OVERLAY ASSEM: incl spindle clip & catch; char brn (PP205CE-1)
	13P63023A63	ESCUTCHEON & OVERLAY ASSEM: incl spindle clip & catch; blu (PP205CL-1)
	13P63023A65	ESCUTCHEON & OVERLAY ASSEM: incl spindle clip & catch; beige (PP205CN-1)
	15E63335A38	HOUSING, rec chgr: char brn (PP205CE-1)
	15E63335A36	HOUSING, rec chgr: blu (PP205CL-1)
	15E63335A37	HOUSING, rec chgr: beige (PP205CN-1)
	15E63367A05	HOUSING, speaker: char brn (PP205CE-1)
	15E63367A03	HOUSING, speaker: blu (PP205CL-1)
	15E63367A04	HOUSING, speaker: beige (PP205CN-1)
	14S10157A04	INSULATOR, plastic: cab strap
	36C63975A02	KNOB, control: vol & tone
	29B61453A02	LUG, terminal: spkr leads
	2A63823A01	NUT, spcl stop: 1/4-20 (chgr hsg pivot)
	13C63131A01	OVERLAY, controls: escut assem (vol L - tone - vol R)
	13B63594A01	OVERLAY, insert: "M" (cab)
	28S10114A08	PLUG, plastic: blk (esc assem)
	42C60126B01	RETAINER, spkr cord: LH
	42C60126B02	RETAINER, spkr cord: RH
	3S134288	SCREW, mach: 1/4-20 x 1 (chgr hsg pivot)
	3S131281	SCREW, mach: 6-32 x 3/8 (spkr mtg)
	3A63100A01	SCREW, spcl: 6-20 (baffleboard)
	3S131125	SCREW, tpg: #6 x 3/8 (cab strap)
	3S135558	SCREW, tpg: #6 x 1/2 (cont escut to cab)
	3S135360	SCREW, tpg: 6-20 x 1/2 (chassis mtg)
	43A63821A01	SPACER, sleeve (chgr hsg pivot)
E-2	50D63671A01	SPEAKER, 5 PM: 8Ω VC
E-3	50D63671A01	SPEAKER, 5 PM: 8Ω VC
	42D60283B01	STRAP, cabinet
	46A60073B01	STUD, locking: cab (spkr hsg to cab)
	4K639573	WASHER, cup: cab (spkr hsg)
	4S10058A39	WASHER, neoprene: 1/16 (chgr hsg pivot)
	4S10058A34	WASHER, neoprene: 1/4 (chgr hsg pivot)
MODEL PP206C-1 SERIES		
	75A63642A01	BUMPER, plastic: chgr hsg stop
	38S10220A02	BUTTON, plug: chgr hsg
	16P63023A74	CABINET, portable: incl hinges, cable channels, bumpers & trim: char brn (PP206CE-1)
	16P63023A70	CABINET, portable: incl hinges, cable channels, bumpers & trim: beige (PP206CN-1)
	42A63840A01	CATCH, chgr hsg
	55B60246B01	CATCH, spkr hsg
	7B63593A04	CHANNEL, cable: char brn (PP206CE-1)
	7B63593A06	CHANNEL, cable: beige (PP206CN-1)
	42A63585A01	CLIP, spindle: 45 RPM
	9A60992A01	CONNECTOR, plastic: spkr leads
	*13P63023A75	ESCUTCHEON & OVERLAY ASSEM: incl clip & catch; char brn (PP206CE-1)
	*13P63023A71	ESCUTCHEON & OVERLAY ASSEM: incl clip & catch; beige (PP206CN-1)
	55C63528A04	HINGE, separable: bott left (cab assem)
	55C63528A02	HINGE, separable: bott right (cab assem)
	55C63528A05	HINGE, separable: RH & LH (spkr hsg)
	55C63528A03	HINGE, separable: top left (cab assem)
	55C63528A01	HINGE, separable: top right (cab assem)
	15E63335A27	HOUSING, rec chgr: char brn (PP206CE-1)
	15E63335A26	HOUSING, rec chgr: beige (PP206CN-1)
	15P63023A73	HOUSING, spkr; LH: incl catch & overlay insert: char brn (PP206CE-1)
	15P63023A72	HOUSING, spkr; RH: incl catch & overlay insert: char brn (PP206CE-1)
	15P63023A69	HOUSING, spkr; LH: incl catch & overlay insert: beige (PP206CN-1)
	15P63023A68	HOUSING, spkr; RH: incl catch & overlay insert: beige (PP206CN-1)
	14S10157A04	INSULATOR, plastic: cab strap
	36C63139A07	KNOB, control: vol & tone
	29B61453A02	LUG, terminal: spkr leads
	2A63823A01	NUT, spcl stop: 1/4-20 (chgr hsg pivot)
	2S10080A08	NUT, spring: 6-18 (spkr mtg)
	13C63120A01	OVERLAY, escut: vol-tone-vol (escut assem)
	13B63594A01	OVERLAY, insert: "M" (cab rear)
	13B60092B01	OVERLAY, insert: "Solid State" (spkr hsg)
	28S10114A08	PLUG, plastic: blk (esc assem)
	42C63722A01	RETAINER, spkr cord
	3S134288	SCREW, mach: 1/4-20 x 1 (rec chgr hsg pivot)
	3A63100A01	SCREW, spcl: 6-20 x .625 (baffleboard mtg)
	3S131125	SCREW, tpg: #6 x 3/8 (cab strap mtg)
	3S135558	SCREW, tpg: #6 x 1/2 (cont escut mtg)
	3S135360	SCREW, tpg: 6-20 x 1/2 (chassis mtg)
	43A63821A01	SPACER, sleeve: chgr hsg pivot
E-2	50D63626A02	SPEAKER, 6 PM: 8Ω VC
E-3	50D63626A02	SPEAKER, 6 PM: 8Ω VC
	41A60270B01	SPRING, spkr hsg
	42D60283B01	STRAP, cabinet
	46A60449B01	STUD, spkr hsg
	*13A63408A01	TRIM, cab front: 14-21/32
	*13C60382B01	TRIM, cab front: 40-5/32
	4K538354	WASHER, cup: hinge mtg: cab (USE 4K639947)
	4S10058A39	WASHER, neoprene: 1/16 (chgr hsg pivot)
	4S10058A34	WASHER, neoprene: 1/4 (chgr hsg pivot)
		PARTIAL RECORD CHANGER PARTS LIST (PARTS UNIQUE TO M115RC AND M116RC)
	49P63020A75	ADAPTOR, 50 cycle
	59C61496A01	CARTRIDGE, M115RC
	59C60459B01	CARTRIDGE, M116RC
	49P63020A14	IDLER WHEEL
	36P63027A01	LEVER, control
	59P63020A16	MOTOR, phono
	47B63772A01	SPINDLE, 45 RPM
	92-148DS	STYLUS: dia-sapph M115RC
	92-148SS	STYLUS: sapph-sapph M115RC
	92-813DS	STYLUS: dia-sapph M116RC
	92-813SS	STYLUS: sapph-sapph M116RC
	45P63027A50	TONE ARM ASSEM

*DENOTES NEW ITEM APPEARING IN ANY LIST FOR FIRST TIME.

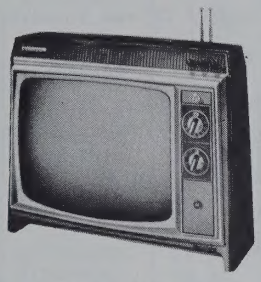
SUPPLEMENT NO. 1
TO TS-594 SERVICE MANUAL,
PART NO. 68P65135A58

television **MANUAL 68P65135A59**

CHASSIS TS-594

MODELS BP505C, 506C, BT604C, BU774C, 775C, 776C, 777C

MOTOROLA service manual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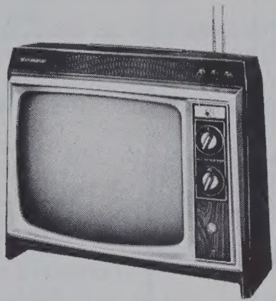
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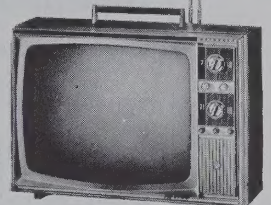
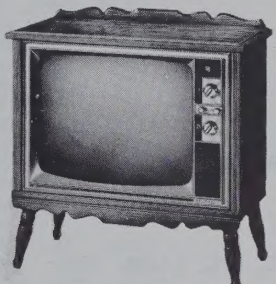

MODEL BT604C

MODEL BU774C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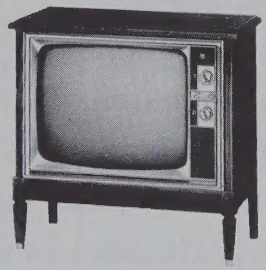
MODEL BU776C

MODEL BU777C

GENERAL INFORMATION

This supplement introduces new receivers added to the line since the publication of the original TS-594 Service Manual and also contains information regarding chassis changes and revisions.

This supplement includes a complete revised schematic diagram, complete revised parts list and tuner service information. For all other information, refer to the original service manual.

VHF TUNER - CPTT-406

The CPTT-406 VHF tuner, Part No. 77D67944B06, is electrically the same as the OPTT-396 tuner. For schematic diagram, alignment and servicing information, refer to pages #15 thru #20 in the original service manual. Parts list for the OPTT-396Y applies to the CPTT-406.

MODEL BREAKDOWN CHART

MODEL	CHASSIS	VHF TUNER	UHF TUNER	CRT
BP505CN	C18TS-594	CPTT-406	HTT-624 or HTT-627	19GFP4
BP506CB, CC, CW	D18TS-594	CPTT-406	HTT-624 or HTT-627	19GFP4
BT604CW	D20TS-594	OPTT-404 or OPTT-406	HTT-624 or HTT-627	21FZP4 or 21FVP4
BU774CW	C22TS-594	OPTT-404 or OPTT-406	HTT-624 or HTT-627	23GXP4, 23GSP4, 23HLP4 or 23FSP4
BU775CS	C22TS-594	OPTT-404 or OPTT-406	HTT-624 or HTT-627	23GXP4, 23GSP4, 23HLP4 or 23FSP4
BU776CM	C22TS-594	OPTT-404 or OPTT-406	HTT-624 or HTT-627	23GXP4, 23GSP4, 23HLP4 or 23FSP4
BU777CF	C22TS-594	OPTT-404 or OPTT-406	HTT-624 or HTT-627	23GXP4, 23GSP4, 23HLP4 or 23FSP4

television MANUAL 68P65135A59 MODELS BP505C, 506C, BT604C, BU774C, 775C, 776C, 777C CHASSIS TS-594

MOTOROLA INC. 9401 WEST GRAND AVENUE, FRANKLIN PARK, ILLINOIS
PART NO. 68P65135A59 2-67 PRICE 35 CENTS

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CHASSIS CODING CHANGES

Chassis Coding	Chassis Coding Changes
NO CODE CHANGE	TO REDUCE TRAP DRIFT: C-103 changed from NPO to N150.
	TO REDUCE LINE RADIATION: E-807 added (delete R-800).
TS-594B-01	TO PREVENT REGENERATION ON LOW CHANNELS: L-114 added in series with collector of video output transistor, Q-5.
	C-808, .001mf, +100-0% Z5U capacitor added.
TS-594C-01	TO PROVIDE MORE HIGH VOLTAGE AND TO FIX NON-SYNCHRONOUS RASTER: T-500 changed from Part No. 24D67602A04 to 24D67602A07.
	NOTE: Use Part No. 24D67602A04 only on chassis coded prior to C-01. Do not substitute 24D67602A07 for the 24D67602A04.
	R-519 changed from 220K, 10%, 1W to 100K, 10%, 2W.
	R-522 changed from 10K, 10%, 3W to 8.2K, 10%, 3W.
	C-519, Part No. 21S120872, 56pf, 10%, N750 added.
	E-502, Part No. 48D67120A10, diode added.
	R-507 in original service manual was changed to R-523, 220K, 10%, 1/2W and connected to filtered boot.
	R-525, 120K, 10%, 1/2W added.
	R-524, 100K, 10%, 1/2W added.
	C-809, 20mf electrolytic, added.
	R-809, 470, 10%, 1/2W added on tuner (RF B+).
	C-520, .005mf, 1KV disc capacitor added.
	R-203 changed from 68K, 10%, 1/2W to 150K, 10%, 1/2W.
	R-206, 6.8K, 10%, 1W added.
	C-202 changed from 18pf, 10%, N150 to 82pf, 10%, N750 and relocated.
	R-315 changed from 270K, 10%, 1/2W to 560K, 10%, 1W.
	R-306 changed from 2.2 meg, 10%, 1/4W to 1.8 meg, 10%, 1/4W.
	R-308 changed from 2.2 meg, 10%, 1/4W to 680K, 10%, 1/4W.
	C-512 deleted on C and 22TS-594 (23") chassis. Changed from 180pf, 10%, N1500 to 100pf, 10%, N1500 on JTS, 18TS, D18TS and D20TS (19" and 21") chassis.
TS-594C-03	ADDED RELIABILITY: CRT socket changed from Part No. 9C67191A07 (with internal spark gap) to Part No. 9C67191A08 (with external spark gap).
TS-594C-05	TO IMPROVE VIDEO BIAS: R-117 changed from 10% to 5% tolerance.
	R-120 changed from 1.2K, 10%, 1/2W to 1K, 10%, 1/2W.
	R-506 changed from 6.8 meg, 10%, 1/2W to 5.6 meg, 10%, 1/2W.
	TO CORRECT HORIZONTAL SIZE: R-522 changed from 8.2K, 10%, 2W to 6.8K, 10%, 3W.
	C-512 changed from 0 to 68pf, 10%, 4KV on 22" chassis and changed from 100pf to 180pf, 10%, 4KV on 18" and 20" chassis.
	C-503 changed from .15, 20%, 100V to .05, 20% 100V (for faster timing in AFC circuit).

REPLACEMENT PARTS LIST (Supersedes Parts List Found In Original Service Manual)

Ref. No.	Part Number	Description
		ELECTRICAL PARTS
CAPACITORS - NOTE:		The capacitors in this list are recommended replacement types for the original equipment; all are ceramic disc type unless otherwise specified.
	21S122942	4.7 pf ± .5 500V NPO
	21S180B50	4.7 pf ± .5 500V NPO (USE 21S122942)
	21S180B43	7.5 pf ± .25 500V NPO (USE 21S132521)
	21S180C34	7.5 pf ± .25 100V N150
	21S180B61	8.2 pf ± .25 500V NPO
	21S180C35	8.2 pf ± .25 100V N150
	21S410063	10 pf ± .5 500V NPO
	21S180B66	11 pf 5% 500V NPO (USE 21R410063)
	21S180A51	15 pf 5% 500V NPO (USE 21S125066)
	21S125066	15 pf 5% 500V NPO
	21S120578	18 pf 10% 500V N150
	21S128698	18 pf 10% 500V N750
	21S125944	22 pf 10% 500V N750
	21S180B46	33 pf 5% 500V NPO (USE 21S131261)
	21S119912	33 pf 10% 500V N150
	21S180B94	33 pf 10% 500V NPO (USE 21R131621)
	21S180B78	39 pf 5% 500V NPO (USE 21S180A27)
	21S180C03	39 pf 10% 500V N750 (USE 21S122051)
	21S180C33	39 pf 10% 100V N150
	21S132265	47 pf 5% 500V NPO
	21S180B77	47 pf 5% 500V N150
	21S114207	47 pf 10% 500V N750
	21S180B82	47 pf 10% 500V N150 (USE 21R122822)
	21S180C04	56 pf 10% 500V NPO (USE 21S180 A79)
	21S120872	56 pf 10% 500V N750
	21S129652	68 pf 10% 500V N750
	21S180B35	68 pf 10% 4KV
	21S128698	82 pf 10% 500V N750
	21S180B93	82 pf 10% 500V N750 (USE 21S128698)
	21S131897	91 pf 10% 3KV N1500
	21S180B97	100 pf 10% 100V N330
	21S127589	100 pf 10% 4KV N1500
	21S180B58	100 pf 5% 100V N330 (USE 21S180B59)
	21S180B80	120 pf 10% 500V N750
	21S132491	150 pf 10% 500V N750
	21S125513	180 pf 10% 5KV N2200
	21S180A88	180 pf 10% 4KV
	21S180B81	220 pf 5% 500V X5F
	*21S180B87	220 pf 10% 500V X5F
	21S180B47	220 pf 10% 500V N750
	21S180A94	220 pf 20% 2KV N1500
	21S180C06	330 pf 10% 500V Z5F
	21S121797	470 pf 10% 500V Z5F
	21S180B48	470 pf 10% 500V X5F (USE 21K751273)
	21S180B53	470 pf 10% 500V X5F
	21S180B51	.001 mf 10% 500V X5F
	21S128045	.001 mf 10% 500V Z5F
	21S180B07	.001 mf 10% 500V Z5F (USE 21S128045)
	21S132293	.001 mf +100-0% 500V Z5U (USE 21R128045)
	21S132350	.0015 mf 10% 500V X5F
	21S132146	.0015 mf 10% 500V X5F (USE 21K132081)
	21S132419	.0015 mf +100-0% 1.4KV Z5U
	21S180B05	.0018 mf 10% 500V X5F
	21S180B57	.0018 mf 10% 500V Z5F (USE 21S129183)
	21S121106	.002 mf 20% 500V Z5F (USE 21K121836)
	21S131740	.0022 mf 20% 500V Z5F
	21S131908	.0027 mf +100-0% 2KV Z5U
	8S10064A29	.0033 mf 10% 400V mylar (USE 8R10110A02)
	21S180B06	.0033 mf 20% 500V X5F
	21S131777	.0039 mf 20% 500V Z5F (USE 21R125162)
	21S180C05	.0047 mf 10% 500V Z5F (USE 21S121764)
	8S10072A12	.005 mf 10% 400V mylar
	21S180B67	.005 mf 10% 500V Z5F (USE 21S128634)
	21S180B54	.005 mf 20% 500V Z5F (USE 21R128634)
	21S115312	.005 mf +100-0% 500V Z5U (USE 21A738298)
	21S124738	.005 mf +100-0% 1KV Z5U (USE 21A738298)
	21S180A41	.0068 mf 20% 500V Z5U (USE 21R131333)
	8S10169A02	.01 mf 10% 400V mylar (USE 8S10064A07)
	21S482726	.01 mf +100-0% 500V Z5U
	21S131733	.01 mf +100-0% 2KV Z5U
	21S180B56	.015 mf 20% 500V Z5U (USE 21S131672)
	8S10169A34	.022 mf 10% 400V mylar (USE 8S10064A57)
	8S10169A01	.03 mf 10% 400V mylar (USE 8S10064A05)
	8S10169A79	.047 mf 10% 100V mylar
	8S10191A20	.047 mf 20% 160V poly mylar (USE 8K129455)
	8S10064C14	.047 mf 20% 200V (USE 8R10064D14)
	8S10169A10	.05 mf 20% 200V mylar (USE 8S10064D15)
	8S10169B19	.05 mf 20% 100V
	8S10169A14	.05 mf 20% 400V mylar (USE 8S10064D15)
	8S10169A09	.1 mf 20% 100V mylar (USE 8S10064B17)
	8S10169A71	.1 mf 20% 100V mylar (USE 8K128692)
	8S10169A15	.1 mf 20% 400V mylar (USE 8S10064A70)
	8S10169A19	.1 mf 20% 600V mylar (USE 8R10064A45)
	8S10169A69	.15 mf 20% 100V mylar (USE 8S10064B18)
	8S134271	.15 mf 20% 400V mylar
	21S10003A10	.2 mf +80-20% 10V Y5K (USE 21S10000A08)
	8S10169A67	.22 mf 20% 200V mylar (USE 8S10169A60)
	8S10169A40	.25 mf 20% 200V mylar (USE 8R10064A71)
	21S10003A14	.47 mf +80-20% 10V Y5K (USE 21S10003A05)
C-309, C-310	23S10229A06	1 mf +40-20% 25V electrolytic
C-404	23D65282A38	2 mf +100-0% 100V electrolytic
C-809	*23C65808A28	20 mf/175V electrolytic
C-805	23C65807A21	150-20/350V, 200-120/175V electrolytic
C-804	23C65808A17	200 mf +100-0% 175V electrolytic
C-129	23C65282A26	400 mf 20% 3V electrolytic
C-807	23D65282A36	500 mf +100-10% 50V electrolytic
MISCELLANEOUS ELECTRICAL PARTS		
E-100	48C65837A02	DIODE, crystal (video detector)
E-200	48D67120A02	DIODE, horizontal blanking
E-300	48C65837A02	DIODE, crystal (ratio detector)
E-301	48C65837A02	DIODE, crystal (ratio detector)
E-400	48D67120A09	DIODE, crystal (AGC gate)
E-500	48D67120A02	DIODE, horizontal phase detector
E-501	48D67120A02	DIODE, horizontal phase detector
E-502	48D67120A10	DIODE, horizontal osc
E-600	48C65837A02	DIODE, vertical bias clamp
E-601	48D67120A02	DIODE, vertical output bias
E-602	51D65239A22	RES-CAP, integrator
E-800	80C66390A17	CIRCUIT BREAKER
E-802	48S191A05	RECTIFIER, silicon: 500 ma
E-803	48S191A05	RECTIFIER, silicon: 500 ma
E-804	48S134858	DIODE, Zener (transistor B+ regulator)
E-805	65S125595	LAMP, pilot: VHF (#1847)
E-806	65S125595	LAMP, pilot: UHF (#1847)
E-807	51C67517A01	RES-CAP, line to chassis gnd
COILS & CHOKES		
L-100,1	24D67754A13	41.25 & 37.50MC TRAP: incls core
L-102	24D67754A05	CONVERTER SEC: incls core
L-103	24D67754A06	47.25MC TRAP: incls core
L-104,5	24V66552A05	1ST IF INTERSTAGE & 47.25MC TRAP ASSEM: incls core
L-106	24D67754A04	2ND IF INTERSTAGE: incls core
L-107	24C66772A08	CHOKE, IF: resonant 46Mc
L-108	24C66772A08	CHOKE, IF: resonant 46Mc
L-109	24D68002A21	COMPENSATING: 330 uh
L-110	24V66550A85	4.5MC TRAP: incls C-127, C-128; R-117, R-118 & core
L-111	24D68002A20	COMPENSATING: 650 uh
L-112	24D67324A49	COMPENSATING: 100 uh/8.2K
L-114	24D68002A30	COMPENSATING: 7.5 uh
L-200	24S131266	CHOKE, suppressor (46Mc)

Ref. No.	Part Number	Description
L-500	24D65853B04	HORIZONTAL OSC: incls core & mtg nut
L-501	24C66772A05	HORIZONTAL SUPPRESSOR: 6.6 uh
L-502	24C65828A17	COMPENSATING: 6.6 uh
L-503	24D65698A12	HORIZONTAL SIZE: incls core & mtg nut
L-700	24D67621B06	YOKE, deflection: 114° (JTS)
	24D67621B04	YOKE, deflection: 114° (22TS)
	24G10250A02	YOKE, deflection: 114° (C22TS - USE 24D67621B04)
	24G10250A05	YOKE, deflection: 114° (C18TS & D18TS - USE 24D67621B05)
	24G10250A06	YOKE, deflection: 114° (D20TS - USE 24D67621B06)
L-800	24C67534A04	CHOKE, line
TRANSISTORS		
Q-1	48S134845	1ST IF AMP (M4845)
Q-2	48S134845	2ND IF AMP (M4845)
Q-3	48S134844	3RD IF AMP (M4844)
Q-4	48S134841	1ST VIDEO AMP (M4841)
Q-5	48S134819	VIDEO OUTPUT (M4819)
Q-6	48S134840	AUDIO IF (M4840)
Q-7	48S134898	AUDIO DRIVER (M4898, A1A)
Q-8	48S134843	AGC GATE (M4843)
Q-9	48S134910	AGC AMP (P1C)
Q-10	48S134842	NOISE GATE (M4842)
Q-11	48S134853	SYNC SEPARATOR (M4853)
TRANSFORMERS		
T-100	24T66550A78	VIDEO DET TRANSFORMER ASSEM: incls E-100, C-119, C-122, C-124 & L-107
T-300	24V66550A79	AUDIO TAKE OFF: incls C-301, C-302, C-303 & core
T-301	24V66550A80	RATIO DET: incls C-306, C-307, E-300, E-301 & R-304
T-302	25D67552A02	AUDIO OUTPUT
T-500	24D67602A04	HORIZONTAL OUTPUT & HV: complete (pri-sec winding can be purchased separately - see below)
	*24D67602A07	HORIZONTAL OUTPUT & HV: complete (C-01 & later)
	24D67601A04	PRIMARY/SECONDARY: winding only; incls V-9 plate cap
	*24D67601A08	PRIMARY/SECONDARY: winding only; incls V-9 plate cap (C-01 & later)
T-600	25D65840A19	VERTICAL OUTPUT
T-800	25D67448A03	POWER
RESISTORS		
	17S754501	3.9 10% 2W WW
	17S647606	82 10% 10W
	17S10130A22	220 10% 3W glass
	17S135528	1800 5% 10W WW
	17S737686	6.8K 10% 3W
	17S135529	8200 10% 10W WW
	17S744464	10K 10% 3W glass
	17S754221	12K 10% 2W glass
	17S10130A28	18K 10% 3W glass (USE 17B66030A03)
	*17S10130A70	100K 10% 2W glass
R-200	6C66263A08	VARISTOR (brightness)
R-618	6C66263A07	VARISTOR (vertical)
R-701	6C65884A07	THERMISTOR (yoke)
CONTROLS		
R-124	18D67502A05	CONTRAST: 30K (JTS & D20TS)
	18D66966A20	CONTRAST: 30K (22TS & C22TS)
	18D67637A55	CONTRAST: 30K (C18TS - D18TS)
R-133	18D67637A37	OPTIMIZER: 750Ω
R-201	18D66966A19	BRIGHTNESS: 100K (JTS & D20TS)
	18D66966A09	BRIGHTNESS: 100K (22TS & C22TS)
	18D66966A40	BRIGHTNESS: 100K (C18TS - D18TS)
R-314	18D65083A55	VOLUME: on-off sw: 2 meg (JTS & D20TS)
	18D67559A12	VOLUME: on-off sw: (tab mtg) 2 meg: (22TS & C22TS)
	18D66836A25	VOLUME: on-off sw: 2 meg (C18TS & D18TS)
	18D68021A06	VOLUME: on-off switch: bushing mtg 2 meg (less mtg nut 2S7051) 22TS & C22TS (USE 18D68021A01)
R-405	18D67637A37	NOISE GATE: 750Ω
R-411	18D66401A16	RF AGC DELAY: 10K
R-604	18D66966A18	VERTICAL HOLD: 750K (JTS & D20TS)
	18D66966A21	VERTICAL HOLD: 750K (22TS & C22TS)
	18D67637A56	VERTICAL HOLD: 750K (C18TS & D18TS)
R-608	18D66966A23	VERTICAL SIZE: 4 meg
R-617	18D67637A36	VERTICAL LINEARITY: 500K
R-803	18D67637A54	1ST VIDEO BIAS: 30K
		MECHANICAL PARTS
	84V66556A27	BOARD, plated chassis: less components
	43B66656A04	BUSHING, horiz size control adj. rod
	43A754070	BUSHING, nylon (UHF tuner mtg)
	43C67077A02	BUSHING, snap in (insulates red & blk yoke leads from chassis)
	30V66545A28	CABLE, UHF coax: incls plugs
	1V66551A04	CABLE, VHF coax: incls plug & ret clamp (VHF tuner to chassis - JTS & D20TS)
	*1V66556A35	CABLE, VHF coax: incl plug & ret clamp (VHF tuner to chassis - 22TS)
	*1V66558A51	CABLE, VHF coax: incl plug & ret clamp (VHF tuner to chassis - C22TS)
	*1V66588A47	CABLE, VHF coax: incl plug & ret clamp (VHF tuner to chassis - C18TS & D18TS)
	42B66166A06	CLAMP, capacitor ret: steel, 1.00" dia
	42B66166A02	CLAMP, capacitor ret: steel, 1.375" dia
	42A742819	CLAMP, yoke cover
	39C66357A03	CLIP, ground: (18TS & D18TS)
	42A65602A01	CLIP, ground: UHF tuner
	42C66218A08	CLIP, spring nut: chassis mtg
	42K753665	CLIP, wire (2nd anode lead ret in HV cage)
	42C65864A14	CONNECTOR, anode: incls lead (JTS, D20TS, 22TS & C22TS)
	42C65864A21	CONNECTOR, anode: incl lead (C18TS & D18TS - USE 42C65864A19)
	9C66133A02	CONNECTOR, plate cap: V-6 (USE 42A736032)
	9C66133A06	CONNECTOR, plate cap (V-9 - USE 9C66133A11)
	76C66210A01	CORE, iron: T-500 (2 required)
13	44D67371A03	GEAR, driven: fine tuning; lge (on fine tuning shaft - hub fits 5/8" hole in tuner brkt - JTS, D20TS, 22TS & C22TS)
	44D67371A05	GEAR, driven: fine tuning; large (on fine tuning shaft - hub flush with tuner brkt)
16	44C67370A06	GEAR, driver: fine tuning: with shaft (JTS, D20TS, 22TS, C22TS)
14	44C67370A02	GEAR, intermediate: fine tuning (tuner brkt - JTS, D20TS, 22TS, C22TS)
	5K790684	GROMMET, insulating (V-7 socket mtg)
	5K754071	GROMMET, rubber (UHF tuner mtg)
	5A741077	GROMMET, strain relief: HV shield
	26A66745A01	HEAT SINK (video output Q-5)
15	42C67369A01	HOUSING, gear retainer (tuner brkt - JTS, D20TS, 22TS & C22TS)
	14K754520	INSULATOR, cup: HV rect socket
	14B65732A03	INSULATOR, round recept (focus lead)
	9C66402A03	LUG, terminal (focus lead)
	9C66402A05	LUG, terminal: ant leads
	29A739899	LUG, terminal: yoke & spkr leads
	2C720979	NUT, coil mtg: horiz osc coil
	2S7051	NUT, hex: 3/8-32 (cont mtg)
	28K743342	PLUG, AC line cord (on chassis - USE 28A736068)
	9C67349A02	RECEPTACLE, plug: 1-pin (IF input)
	47C66082A02	ROD, adjust: horiz hold
	47C66082A03	ROD, adjust: horiz size
	43K754432	SHIELD, pilot light: UHF-VHF JTS & D20TS)
	*26B68206A01	SHIELD, pilot light: UHF-VHF (22TS & C22TS)
	26A67689A02	SHIELD, pilot light: UHF-VHF (C18TS & D18TS - USE 26A68209A01)
	9C67191A06	SOCKET, CRT

Ref. No.	Part Number	Description
	9C67191A08	SOCKET, CRT (C-03 & later)
	9C65910A06	SOCKET, pilot light & brkt (VHF-UHF - JTS & D20TS)
	9S10143A04	SOCKET, pilot light & brkt (22TS & C22TS)
	9C65910A08	SOCKET, pilot light & brkt (C18TS & D18TS)
	9D66121A02	SOCKET, transistor (Q-1 thru Q-11)
	9D66121A04	SOCKET, TRANS (Q-5, Q-7, Q-8 & Q-11 - USE 9D66121A02)
	9K702360	SOCKET, tube: 9-pin (V-3 & V-6 - USE 9B702428)
	9C66296A05	SOCKET, tube: 9-pin (V-4 - USE 9C66296A05)
	9K470425	SOCKET, tube: 9-pin (V-7 - USE 9K702428)
	9D66770A05	SOCKET, tube: 12-pin (V-9)
	9D66770A03	SOCKET, tube: 12-pin (V-5 - USE 9D66770A02)
	80C68147A01	SPARK GAP: CRT socket (C-03 & later)
	41A66225A02	SPRING, core clamp: T-500
	41C65987A02	SPRING, ground: CRT
		CABINET PARTS
MODEL BT601CE & CH		
	85P65145A16	ANTENNA, UHF: "bow-tie"
	13P65145A17	BEZEL, CRT: incls overlays, nameplate & medallion
	75C66381A03	BUMPER, rubber (CRT & bezel mtg)
	43A68023A01	BUSHING, fine tuning knob shaft
	16E67871A24	CABINET, metal (BT601CE)
	16E67871A25	CABINET, metal (BT601CH)
	42A65602A01	CLIP, grounding (CRT strap to bezel)
	43B67666A01	COLLAR, monopole antenna mtg
	39A67719A01	CONTACT, spring (monopole antenna)
	30D65580A04	CORD, AC line (USE 30D65580A03)
	15E67358A32	COVER, cabinet back; char (BT601CE)
	15E67358A42	COVER, cabinet back; wht (BT601CH)
	34D67775A02	DIAL SCALE, UHF
	34D67883A01	DIAL SCALE, VHF
	75C67884A01	FOOT, cabinet (on bezel bottom)
	36D67889A06	KNOB, brightness, vertical hold & contrast
	36D67882B04	KNOB, fine tune
	36D67882B02	KNOB, on-off-volume
	36D67738A03	KNOB, UHF
	36D67738A01	KNOB, VHF
	13C67810A06	MEDALLION
	33D68113A01	NAMEPLATE, bezel
	2S10101A12	NUT, push on (spkr mtg)
	13C67887A17	OVERLAY, brightness, contrast, vertical hold
	13C67887A15	OVERLAY, on-vol, fine tune
	42C67888A01	RETAINER, wire: CRT
	3D66303A03	SCREW, tpg: chassis to cab mtg
	3S135391	SCREW, tpg: cab back mtg (#6-18 x 1/2)
	3S132019	SCREW, tpg: CRT retainer (#8-18 x 2-3/4)
	1C67859A01	SLEEVE & SPRING (monopole ant)
	50C66355A03	SPEAKER, 3x5" PM
	2C65722A10	SPEEDNUT, CRT retainer
	42B67886A01	STRAP, CRT mtg (secures CRT retainer to bezel-4 required)
	42B753092	TERMINAL, screw: UHF-VHF antenna
	1C67665A04	TUBE, ROD & BALL ASSEM: monopole ant
	1V66547A98	WIRED PANEL ASSEM: monopole antenna
MODEL BT602CE & CN		
	85P65145A16	ANTENNA, UHF: "bow-tie"
	13P65143A09	BEZEL, CRT: incls nameplate, overlays, channel window & medallion
	75C66381A03	BUMPER, rubber (CRT to bezel mtg)
	43A68023A01	BUSHING, fine tuning knob shaft
	16E67871A26	CABINET, metal table: charcoal brown (BT602CE)
	16E67871A27	CABINET, metal table: beige (BT602CN)
	42A65602A01	CLIP, grounding (CRT strap to bezel)
	43B67666A01	COLLAR, monopole ant mtg
	39A67719A01	CONTACT, spring (monopole antenna)
	30D65580A04	CORD, AC line (USE 30D65580A03)
	15E67358A32	COVER, cabinet back: less all components (BT602CE)
	15E67358A42	COVER, cabinet back: less all components (BT602CN)
	34D67775A02	DIAL SCALE, UHF
	34D67883A01	DIAL SCALE, VHF
	50D67734A01	EARPHONE
	75C67884A01	FOOT, cabinet
	55D67392A10	HANDLE, cabinet: complete
	9C67498A01	JACK, earphone
	36D67889A06	KNOB, brightness, vertical hold & contrast
	36D67882B04	KNOB, fine tuning
	36D67882B02	KNOB, on-off volume
	36D67738A03	KNOB, UHF channel selector
	36D67738A01	KNOB, VHF channel selector
	13C67810A06	MEDALLION "M"
	33D68113A01	NAMEPLATE, bezel
	2S10101A14	NUT, push-on (secures earphone jack)
	2S10101A12	NUT, push-on (spkr mtg)
	13C67887A18	OVERLAY, bezel: "B, C, V"
	13C67887A16	OVERLAY, bezel: "on-vol, fine tuning"
	13C68115A02	OVERLAY, bezel: UHF
	13C68115A01	OVERLAY, bezel: VHF
	42C67888A01	RETAINER, wire: CRT
	3D66303A03	SCREW, tpg: chassis to cab mtg
	3S135391	SCREW, tpg: #6 - 18 x 1/2 (cab back mtg)
	3S132019	SCREW, tpg: #8 - 18 x 2-3/4 (CRT retainer)
	1C67859A01	SLEEVE & SPRING ASSEM: monopole ant mtg
	50D66355A03	SPEAKER, 3" x 5" PM 8Ω VC
	2C65722A10	SPEEDNUT (CRT retainer)
	42B67886A01	STRAP, CRT mtg (secures CRT retainer to bezel - 4 required)
	42B753092	TERMINAL, screw: UHF & VHF antenna
	1C67665A04	TUBE, ROD & BALL ASSEM: monopole antenna
	61B68033A04	WINDOW, channel number
	1V66547A98	WIRED PANEL ASSEM: monopole ant
MODEL BT603CH, CS & CW		
	85P65145A16	ANTENNA, UHF: "bow-tie"
	13P65143A10	BEZEL, CRT: incls nameplate, overlays, channel window & medallion (BT603CH)
	13P65143A11	BEZEL, CRT: incls nameplate, overlays, channel window & medallion (BT603CS)
	13P65143A12	BEZEL, CRT: incls nameplate, overlays, channel window & medallion (BT603CW)
	75C66381A03	BUMPER, rubber (CRT to bezel mtg)
	43A68023A01	BUSHING, fine tuning knob shaft
	16E67871A30	CABINET, metal table: white oak (BT603CH)
	16E67871A29	CABINET, metal table: maple (BT603CS)
	16E67871A28	CABINET, metal table: walnut (BT603CW)
	42A65602A01	CLIP, grounding (CRT strap to bezel)
	43B67666A01	COLLAR, monopole antenna mtg
	39A67719A01	CONTACT, spring (monopole ant)
	30D65580A04	CORD, AC line (USE 30D65580A03)
	15E67358A42	COVER, cabinet back: less all components (BT603CH)
	15E67358A44	COVER, cabinet back: less all components (BT603CS)
	15E67358A32	COVER, cabinet back: less all components (BT603CW)
	34D67775A02	DIAL SCALE, UHF
	34D67883A01	DIAL SCALE, VHF
	50D67734A11	EARPHONE
	75C67884A01	FOOT, cabinet
	55D67392A14	HANDLE, cabinet: complete (BT603CH)
	55D67392A13	HANDLE, cabinet: complete (BT603CS)
	55D67392A12	HANDLE, cabinet: complete (BT603CW)
	9C67498A01	JACK, earphone
	36D67889A06	KNOB, brightness, vertical hold & contrast
	36D67882B04	KNOB, fine tuning
	36D67882A02	KNOB, on-off volume (USE 36D67882B02)

Ref. No.	Part Number	Description
	36D67738A03	KNOB, UHF channel selector
	36D67738A01	KNOB, VHF channel selector
	13C67810A06	MEDALLION "M"
	33D68113A01	NAMEPLATE, bezel
	2S10101A14	NUT, push-on (secures earphone jack)
	2S10101A12	NUT, push-on (spkr mtg)
	13C67887A21	OVERLAY, bezel: "B, C, V" (BT603CH)
	13C67887A20	OVERLAY, bezel: "B, C, V" (BT603CS)
	13C67887A19	OVERLAY, bezel: "B, C, V" (BT603CW)
	13C67887A16	OVERLAY, bezel: "on-vol, fine tuning"
	13C68115A02	OVERLAY, bezel: UHF (BT603CH)
	13C68115A09	OVERLAY, bezel: UHF (BT603CS)
	13C68115A04	OVERLAY, bezel: UHF (BT603CW)
	13C68115A01	OVERLAY, bezel: VHF (BT603CH)
	13C68115A08	OVERLAY, bezel: VHF (BT603CS)
	13C68115A03	OVERLAY, bezel: VHF (BT603CW)
	42C67888A01	RETAINER, wire: CRT
	3D66303A03	SCREW, tpg: chassis to cab mtg
	3S135391	SCREW, tpg: #6 - 18 x 1/2 (cab back mtg)
	3S132019	SCREW, tpg: #8 - 18 x 2-3/4
	1C67859A01	SLEEVE & SPRING ASSEM: monopole antenna
	50C66355A03	SPEAKER, 3" x 5" PM 8Ω VC
	2C65722A10	SPEEDNUT (CRT retainer)
	42B67886A01	STRAP, CRT mtg (secures CRT retainer to bezel - 4 required)
	42B753092	TERMINAL, screw: UHF & VHF antenna
	1C67665A04	TUBE, ROD & BALL ASSEM: monopole antenna
	61B68033A04	WINDOW, channel number
	1V66547A98	WIRED PANEL ASSEM: monopole ant

MODELS BT701CE, CN & BT702CW

Ref. No.	Part Number	Description
	85P65145A16	ANTENNA, UHF: "bow-tie"
	1C67665A04	ANTENNA, VHF: tube, rod and ball assem
	13P65145A18	BEZEL, CRT: incls nameplate & ctrl door (BT701CE, CN)
	13P65145A19	BEZEL, CRT: incls nameplate, overlays & ctrl (BT702CW)
	16E67765A06	CABINET, metal: charcoal (BT701CE)
	16E67765A01	CABINET, metal: beige (BT701CN)
	16E67765A05	CABINET, metal: walnut (BT702CW)
	41C65987A09	CLIP, bezel ground: CRT to tuner mtg brkt
	42C66732A02	CLIP, terminal: VHF-UHF antenna terminals
	43B67666A01	COLLAR, antenna (dipole antenna assy)
	30B738152	CORD, AC line (USE 30K741023)
	15E67396A21	COVER, cabinet back: less all components (BT701CE)
	15E67396A22	COVER, cabinet back: less all components (BT701CN & BT702CW)
	34D68231A01	DIAL, scale: UHF
	34D67775A01	DIAL, scale: VHF
	15P65143A45	DOOR, control: incls medallion (BT701CE, CN)
	15P65143A44	DOOR, control: incls medallion (BT702CW)
	55C67418A01	HINGE, control door: LH
	55C67418A02	HINGE, control door: RH
	36C67726A04	KNOB, fine tune
	36C67126A10	KNOB, on-off-vol
	36D67738A03	KNOB, UHF tuner
	36D67738A01	KNOB, VHF tuner
	33D68113A04	NAMEPLATE, bezel
	13C67759A01	OVERLAY, control panel (BT702CW)
	47C66082A02	ROD, horiz adj
	1C67859A01	SLEEVE & SPRING ASSEM: (dipole ant assy)
	50D67480A02	SPEAKER, 3x5" PM
	41C65987A02	SPRING, CRT ground to chassis
	41C65987A09	SPRING, grounding (on braided wire on CRT brkt)
	29A731948	TERMINAL, lug: open ring (tuner mtg brkt to CRT)
	29K730154	TERMINAL, lug: spade (antenna lead)
	29A739899	TERMINAL, speaker lead
	61B68033A02	WINDOW, channel number (BT702CW)
	1V66547A98	WIRED PANEL ASSY, dipole antenna

MODELS BU704CW, BU705CS, BU706CM, BU707CF, CU709CM, CW, BS710CM, CW, BS711CS & BL712CM, CW

Ref. No.	Part Number	Description
	1V66512A94	ANTENNA, UHF loop
	16E67742A03	BASE, criss-cross: mahognay: complete with hardware (BS710CM)
	16E67742A04	BASE, criss-cross: walnut: complete with hardware (BS710CW)
	16E68035A02	BASE, criss-cross: maple: complete with hardware (BS711CS)
	13P65145A18	BEZEL, CRT: incls nameplate and control door (BU704CW, BU705CS, BU706CM & BU707CF)
	13P65145A19	BEZEL, CRT: incls nameplate, overlays and control door (BU709CM, CW, BS710CM, CW, BU711CS, BL712CM, CW)
	16P65143A18	CABINET, console: walnut (BU704CW)
	16P65143A24	CABINET, console: maple (BU705CS)
	16P65145A20	CABINET, console: mahogany (BU706CM)
	16P65145A21	CABINET, console: fruitwood (BU707CF)
	16E68144A01	CABINET, console: mahogany (BU709CM)
	16E68144A02	CABINET, console: walnut (BU709CW)
	16E68145A01	CABINET, console: mahogany (BS710CM)
	16E68145A02	CABINET, console: walnut (BS710CW)
	16E68143A01	CABINET, console: maple (BS711CS)
	16E68142A01	CABINET, console: mahogany (BL712CM)
	16E68142A02	CABINET, console: walnut (BL712CW)
	42C66732A02	CLIP, UHF-VHF antenna terminals
	30B738152	CORD, AC line (USE 30K741023)
	15E67415A28	COVER, cabinet back (BU704CW, BU705CS, BU709CM, CW, BS710CM,CW & BS711CS)
	15E67415A29	COVER, cabinet back (BU706CM & BU707CF)
	15E67415A30	COVER, cabinet back (BL712CM, CW)
	15C66709A08	COVER, CRT rear (USE 15B754377)
	34D68231A01	DIAL, scale: UHF
	34D67775A01	DIAL, scale: VHF
	55C62743A62	DOME GLIDE, beige
	15P65143A45	DOOR, control: incls medallion (BU704CW, BU705CS, BU706CM & BU707CF)
	15P65143A44	DOOR, control: incls medallion (BU709CM, CW, BS710CM, CW BS711CS, BL712CM, CW)
	16E68105A06	GALLERY, cabinet: maple (BU705CS)
	16E68935A03	GALLERY, cabinet: maple (BS711CS)
	35D67457A78	GRILLE CLOTH (BS711CS)
	55C67418A01	HINGE, control door: left side
	55C67418A02	HINGE, control door: right side
	36C67726A04	KNOB, fine tune
	36C67126A10	KNOB, on-off-volume
	36D67738A03	KNOB, UHF tuner
	36D67738A01	KNOB, VHF tuner
	16B68087A03	LEG, cabinet: walnut (BU704CW)
	16B68098A01	LEG, cabinet: maple (BU705CS)
	16E68051A03	LEG, cabinet: mahogany (BL712CM)
	16E68051A04	LEG, cabinet: walnut (BL712CW)
	16E68139A05	LEG & STRETCHER ASSEM: mahogany (BU706CM)
	16E68139A09	LEG & STRETCHER ASSEM: fruitwood (BU707CF)
	29K730154	LUG, spade (antenna leads)
	13C67810A02	MEDALLION, control door
	33D68113A04	NAMEPLATE, bezel
	13C67759A01	OVERLAY, control panel
	47C66082A02	ROD, horizontal adjust
	50D67480A02	SPEAKER, 3x5" PM
	16E68103A05	STRETCHER, cabinet: walnut (BU704CW)
	16E68105A05	STRETCHER, cabinet: maple (BU705CS)
	16E68051A05	STRETCHER, cabinet: mahogany (BL712CM)
	16E68051A06	STRETCHER, cabinet: walnut (BL712CW)
	41A66675A04	SPRING, control door
	41C65987A09	SPRING, grounding (on braided wire on CRT brkt)
	55C62085A83	SWIVEL, metal (BS710CM, CW & BS711CS)
	29A731948	TERMINAL, open (on braided wire on tuner brkt)

Ref. No.	Part Number	Description
MODELS BP505CN, BP506CB, CC, CW		
	85P65133A40	ANTENNA, UHF: "bow-tie"
	45B66404A23	ARM, handle (BP505CN)
	*45B66404A25	ARM, handle (BP506CB,CC,CW)
	*16P65146A54	CABINET FRONT: incl overlay & medallion (BP505CN)
	*16P65146A55	CABINET FRONT: incl overlay,escutcheon & medallion (BP506CB,CC,CW)
	42S10152A02	CLIP, push-on: spkr mtg
	43B67666A01	COLLAR, antenna
	15S10183A04	CONNECTOR, plug: 3-pin; earphone; less contacts
	15S10183A03	CONNECTOR, recept: 3-cont; earphone, less contacts (from chassis)
	39C66357A03	CONTACT (bezel ground wire to chassis)
	39S10184A01	CONTACT, connector: for earphone receptacle 15S10183A03
	39S10184A02	CONTACT, connector: 3-pin; earphone plug
	39A67719A01	CONTACT, SPRING: dipole antenna
	30S183A09	CORD, AC line: incl ret clip
	*15F67801A10	COVER, cabinet back: less all components (BP505CN)
	*15F67801A13	COVER, cabinet back: less all components (BP506CB)
	*15F67801A12	COVER, cabinet back: less all components (BP506CC)
	*15F67801A11	COVER, cabinet back: less all components (BP506CW)
	*34D68429A01	DIAL, UHF (BP505CN)
	*34D68429A02	DIAL, UHF (BP506CB,CC,CW)
	50D67734A01	EARPHONE (BP506CB,CC,CW)
	*13C68428A01	ESCUTCHEON, control panel "SOLID STATE SIGNAL SENSOR" (BP506CB, CC, CW)
	5C66422A05	GROMMET, insulated (chassis mtg)
	55C67499A11	HANDLE, portable TV (BP505CN)
	55C67499A12	HANDLE, portable TV (BP506CB, CC, CW)
	*36D68047A05	KNOB, brightness, vertical hold & contrast (BP505CN)
	*36D68047A06	KNOB, brightness, vertical hold & contrast (BP506CB,CC,CW)
	*36D68430A01	KNOB, fine tuning
	*36D68047A07	KNOB, on-off volume (BP505CN)
	*36D68047A08	KNOB, on-off volume (BP506CB, CC, CW)
	*36D68217A09	KNOB, UHF channel selector
	*1B68353A03	KNOB, VHF channel selector and dial assembly (BP505CN)
	*1B68353A04	KNOB, VHF channel selector and dial assembly (BP506CB,CC,CW)
	29K730154	LUG, spade: ant leads
	*13C67810A13	MEDALLION "M" (BP505CN)
	*13C67810A14	MEDALLION "M" (BP506CB,CC,CW)
	*2S10101A21	NUT, push-on (earphone receptacle mtg - BP506CB, CC, CW)
	2S10101A20	NUT, push-on (medallion mtg)
	*2S10101A22	NUT, push-on (secures escutcheon pin on bezel)
	*13D67820A05	OVERLAY, control panel (BP505CN)
	*13D67819A07	OVERLAY, control panel (BP506CB, CC,CW)
	22A66406A01	PIN, handle retaining
	9C67498A04	RECEPTACLE, earphone (BP505C series - USE 9P65145A04)
	9P65146A71	RECEPTACLE, earphone: incl mtg brkt (BP506C series)
	3S132284	SCREW, tpg: 8-15 x 5/8 (cabinet back mtg)
	*3S132448	SCREW, tpg: 8-32 x 5/8 (chassis mtg)
	1C67859A01	SLEEVE AND SPRING ASSEM: dipole antenna
	*50G10252A02	SPEAKER, 2-1/4" x 6-1/4" PM
	41A67515A01	SPRING, handle arm
	42B753092	TERMINAL, screw: UHF & VHF antenna
	1C67665A02	TUBE, ROD & BALL ASSEM: dipole antenna
	*1V66559A36	WIRED PANEL ASSEM: dipole antenna
MODEL BT604CW		
	85P65145A16	ANTENNA, UHF: "bow-tie" (USE 85P65133A40)
	*13P65146A58	BEZEL, CRT: incls nameplate, overlays, channel window and medallion
	75C66381A03	BUMPER, rubber (CRT to bezel mtg) 8 required
	43A68023A01	BUSHING, fine tuning knob shaft
	*16E67871A35	CABINET, metal table: walnut
	42A65602A01	CLIP, grounding (CRT strap to bezel)
	42C66218A08	CLIP, spring nut (chassis mtg)
	43B67666A01	COLLAR, monopole ant mtg
	39A67719A01	CONTACT, spring (monopole ant)
	30D65580A04	CORD, AC line (USE 30D65580A03)
	*15E67358A50	COVER, cabinet back: less all components
	34D68231A01	DIAL SCALE, UHF
	34D67883A01	DIAL SCALE, VHF
	50D67734A01	EARPHONE
	75C67884A01	FOOT, cabinet (on bezel bottom)
	55D67392A12	HANDLE, cabinet: complete
	9C67498A01	JACK, earphone
	36D67889A06	KNOB, brightness, vertical hold and contrast
	36D67882B04	KNOB, fine tuning (USE 36D68171A02)
	36D67882B02	KNOB, on-off volume (USE 36D68171A01)
	36D67738A03	KNOB, UHF channel selector
	36D67738A01	KNOB, VHF channel selector
	29K730154	LUG, spade: antenna leads
	*13C67810A15	MEDALLION, "M"
	*33D68113B01	NAMEPLATE, bezel "X/11 SOLID STATE SIGNAL SENSOR"
	2S134218	NUT, hex: 1/4-32 (earphone jack mtg)
	2S7053	NUT, push-on (medallion mtg - USE 2S10101A20)
	2S10101A12	NUT, push-on (spkr mtg)
	13C67887A18	OVERLAY, bezel: "B, C, V"
	13C67887A16	OVERLAY, bezel: on-vol fine tune
	13C68115A04	OVERLAY, bezel UHF
	13C68115A03	OVERLAY, bezel VHF
	42C67888A01	RETAINER, wire: CRT
	3S135391	SCREW, tpg: cabinet back mtg
	3D66303A03	SCREW, tpg: chassis to cab mtg
	3S132019	SCREW, tpg: #8-18 x 2-3/4 (CRT retainer)
	1C67859A01	SLEEVE AND SPRING ASSEM: monopole ant mtg
	50D67480A02	SPEAKER: 3 x 5 PM 8Ω VC
	2C65722A10	SPEEDNUT (CRT retainer)
	42B67886A01	STRAP, CRT mtg (secures CRT retainer to bezel - 4 required)
	42B753092	TERMINAL, screw: UHF and VHF antenna
	1C67665A04	TUBE, ROD & BALL ASSEM: monopole ant
	61B68033A04	WINDOW, channel number
	*1V66559A36	WIRED PANEL ASSEM: monopole antenna
MODELS BU774CW, 775CS, 776CM, 777CF		
	1V66512A94	ANTENNA, UHF loop
	*13P65146A59	BEZEL, CRT: incls nameplate, control door & overlays
	16P65143A18	CABINET, console: walnut (BU774CW)
	16P65143A24	CABINET, console: maple (BU775CS)
	16P65145A20	CABINET, console: mahogany (BU776CM)
	16P65145A21	CABINET, console: fruitwood (BU777CF)
	42C66218A08	CLIP, spring nut (chassis mtg)
	42C66732A02	CLIP, UHF & VHF antenna terminals
	30B738152	CORD, AC line (USE 30K741023)
	15E67415A29	COVER, cabinet back: less all components
	15C66709A08	COVER, CRT rear (USE 15K754377)
	34D68231A01	DIAL SCALE: UHF
	34D67775A01	DIAL SCALE: VHF
	*1V66550A03	DOOR, control: incls medallion
	16E68105A06	GALLERY, cabinet: maple (BU775CS)
	55C67418A01	HINGE, control door: left side
	55C67418A02	HINGE, control door: right side
	36C67726A04	KNOB, fine tune
	36C67126A10	KNOB, on-off-volume
	36D67738A03	KNOB, UHF channel selector

Ref. No.	Part Number	Description
	36D67738A01	KNOB, VHF channel selector
	16B68087A03	LEG, cabinet: walnut (BU774CW - USE 16B68087A01)
	16B68098A01	LEG, cabinet: maple (BU775CS)
	16E68139A05	LEG & STRETCHER ASSEM: mahogany (BU776CM)
	16E68139A09	LEG & STRETCHER ASSEM: fruitwood (BU777CF)
	29K730154	LUG, spade (antenna leads)
	13C67810A02	MEDALLION, control door
	*33D68113B04	NAMEPLATE, bezel "X/11 SOLID STATE SIGNAL SENSOR"
	2S10101A22	NUT, push-on (secures escutcheon pin on bezel)
	13C67759A01	OVERLAY, control panel: UHF & VHF
	3B749168	SCREW, tpg (cabinet back mtg)
	3D66303A05	SCREW, tpg (chassis mtg)
	50G10252A01	SPEAKER: 3" x 5" PM (USE 50D67480A02)
	41A66675A04	SPRING, control door
	*41C65987A12	SPRING, grounding: CRT aquadag to chassis
	41C65987A09	SPRING, grounding (on wire on CRT brkt)
	16E68103A05	STRETCHER, cabinet: walnut (BU774CW)
	16E68105A05	STRETCHER, cabinet: maple (BU775CS)
	61B68033A02	WINDOW, channel no

VHF TUNER - OPTT-396Y, OPTT & CPTT-406

ELECTRICAL PARTS

CAPACITORS - NOTE: The capacitors in this list are recommended replacement types for the original equipment; all are ceramic disc type unless otherwise specified.

C-1	21R134153	27 pf dual 10% 100V Z5F
C-2	21R134153	27 pf dual 10% 100V Z5F
C-3	21S132462	100 pf 10% 100V
C-4	21S122050	27 pf 5% 500V
C-5	21S121462	12 pf 10% 500V
C-6	21S125859	5 pf ± .25 pf 500V (USE 21R125928)
C-7	21P65142A37	.001 mf GMV 500V feed-thru
C-8	21P65142A38	4 pf ± .25 pf 500V
C-9	21P65142A39	50 pf 10% 500V
C-10	21P65142A40	40 pf 10% 500V
C-11	21S180A59	3 pf ± .25 pf 500V
C-12	21P65142A37	.001 mf GMV 500V feed-thru
C-13	21S120660	33 pf 10% 500V feed-thru
C-14	21S180A61	2.5 pf ± .25 pf 500V
C-15	21P65142A37	.001 mf GMV 500V feed-thru
C-16	21P65142A37	.001 mf GMV 500V feed-thru
C-17	21P65123A76	3 pf ± .25 pf 500V feed-thru
C-18	21S410127	.001 mf 10% 500V (USE 21R128045)
C-19	21S180A59	3 pf ± .25 pf 500V
C-20	21P65142A37	.001 mf GMV 500V feed-thru
C-21	21P65142A41	10 pf ± 1 pf 500V N560
C-22	21P65142A42	4 pf ± .25 pf 500V N80
C-23	21P65142A37	.001 mf GMV 500V feed-thru
C-24	21S410127	.001 mf 10% 500V (USE 21R128045)

MISCELLANEOUS ELECTRICAL PARTS

E-1	24P65142A43	ANTENNA INPUT ASSEM: complete; incls T-1, C-1 thru C-3; L-1 thru L-3
E-2	40P65142A44	ANTENNA WAFER ASSEM: incls C-4, C-5, L-4, L-10 thru L-15
E-3	40P65142A45	RF PLATE WAFER ASSEM: incls R-3, L-17 thru L-23
E-4	40P65142A46	MIXER GRID WAFER ASSEM: incls R-4, L-24 thru L-30 & C-14
E-5A	59P65142A47	OSCILLATOR ROTOR ASSEM: incls coils; less E-5B & E-5C
E-5B	1P65142A48	PRE-SET SCREW ASSEM: incls gear head screws, spring & holder; less E-5A & E-5C
E-5C	59P65142A49	OSCILLATOR STATOR ASSEM: incls contacts; less E-5A & E-5B
E-6	40P65142A50	SWITCH, UHF B+ & dial light

COILS & CHOKES

L-23	24P65142A67	COIL, RF plate: channel 13
L-30	24P65142A68	COIL, mixer grid: channel 13
L-31	24P65142A69	COIL, mixer output: incls core
L-32	24P65142A71	COIL, master oscillator
L-40	24P65142A70	COIL, mixer screen
L-42	24P65142A66	COIL, UHF input: series
L-43	24P65142A65	COIL, UHF input: shunt
L-44	24P65123A57	COIL, UHF B+

TRANSFORMERS

T-1	24P65142A72	BALUN COIL (on ant input assem)

MECHANICAL PARTS

	77D67944A02	VHF TUNER, OPTT-396Y: complete
	77D67944B04	VHF TUNER, OPTT-406: complete
	77D67944B06	VHF TUNER, CPTT-406: complete
1	45P65142A64	CAM, fine tuning pre-set
2	44P65142A51	GEAR, fine tuning; plastic; incls mtg brkt
3	2P65142A60	NUT, cam retaining
4	2P65142A59	NUT, tinnerman (secures osc rotor to shaft)
5	3P65142A61	SCREW, fine tuning: gear head
6	47P65142A53	SHAFT ASSEM: channel selector; incls fine tuning shaft, front plate & detent wheel
7	47P65142A54	SHAFT, fine tuning: plastic
8	41P65142A62	SPRING, bias (fine tuning gear return)
9	41P65142A63	SPRING, shaft grounding
10	4P65142A57	WASHER, "C" (fine tuning shaft retainer)
11	4P65142A58	WASHER, "C" (secures selector shaft to front plate)
12	4P65142A56	WASHER, spring (mts between ret nut & cam)

VHF TUNER - OPTT-404

ELECTRICAL PARTS

CAPACITORS - NOTE: The capacitors in this list are recommended replacement types; all are ceramic disc type unless otherwise specified.

C-1	21S132293	.001 mf -20 +100% 500V
C-4	21S115950	2.7 pf 10% 500V fixed comp
C-6	21S132144	30 pf 5% 500V N750
C-8	21S131104	12 pf 5% 500V N220
C-9	21S132925	.001 mf 500V feed-thru
C-10	21S132925	.001 mf 500V feed-thru
C-11	21S10167A05	3 pf 10% 500V fixed comp
C-13	21S134221	47 pf 5% 500V feed-thru
C-15	21P65118A94	2 pf 10% 500V fixed comp
C-16	21P65118A98	30 pf 5% 500V feed-thru
C-17	21S132293	.001 mf -20 +100% 500V
C-18	21S132925	.001 mf 500V feed-thru
C-19	21S132793	1.6 pf 10% 500V fixed comp
C-20	21S134329	470 pf 20% 500V (USE 21K134330)
C-21	21S180A76	4.5 pf ± .25 pf 500V NPO
C-22	21S180A77	24 pf 3% 500V N220
C-23	21S115959	1.5 pf 10% 500V fixed comp (USE 21R129763)
C-24	21S132925	.001 mf 500V feed-thru
C-25	21S129652	68 pf 10% 500V N750

MISCELLANEOUS ELECTRICAL PARTS

E-1	24P65118A79	ANTENNA INPUT FILTER ASSEM: incls E-7, E-8, T-2, C-2, C-3, C-5, L-1 & L-2
E-2	40P65114A83	ANTENNA WAFER ASSEM: incls L-9 thru L-13
E-3	40P65114A84	RF PLATE WAFER ASSEM: incls L-15 thru L-20 and R-3

Ref. No.	Part Number	Description
E-4	40P65118A84	MIXER GRID WAFER ASSEM: incls L-22 thru L-27 and R-10
E-5A	1P65121A40	OSCILLATOR ROTOR ASSEM: incls coils less E-5B & E-5C
E-5B	1P65120A45	PRE-SET SCREW ASSEM: incls gear head screws, spring & holder; less E-5A & E-5C
E-5C	47P65118A44	OSCILLATOR STATOR ASSEM: incls contacts; less E-5A & E-5B
E-6	40P65114A85	SWITCH, UHF input: incls C-4 & L-4
E-7	40P65118A77	SWITCH, UHF B+ & dial light
COILS		
L-4	24P65118A71	COIL, UHF input: series
L-5	24P65118A88	COIL, UHF input: shunt
L-6	24P65118A92	COIL, hi band neutralizing: channels 7 - 13
L-8	24P65114A86	COIL, ant wafer: channel 13
L-14	24P65114A20	COIL, RF plate: channel 13
L-21	24P65114A35	COIL, mixer grid wafer: channel 13
L-28	24P65118A81	COIL, master oscillator
L-30	24P65118A31	COIL, mixer screen
TRANSFORMERS		
T-1	24P65144A58	TRANSFORMER, IF output: incl core
T-2	41P65118A90	BALUN COIL (on ant input assem)

MECHANICAL PARTS

Ref. No.	Part Number	Description
1	44P65118A41	GEAR, driven: fine tuning (on front plate)
2	44P65118A40	GEAR, driver: fine tuning (on fine tune shaft)
3	44P65118A39	GEAR, fine tuning (engages fine tuning screw - inside tuner)
	2P65118A35	NUT, tinnerman (secures osc rotor to shaft)
7	3P65119A96	SCREW, fine tuning: gear head
	47P65114A87	SHAFT, channel selector: incls detent wheel
4	47P65118A43	SHAFT, fine tuning
6	42P65120A43	SPRING, bias (retains shaft on front plate)
5	41P65120A39	SPRING, detent & shaft grounding
	14P65120A24	TEST POINT, feed-thru
8	4P65114A52	WASHER "C" (secures fine tuning shaft)
	77D67381A11	VHF TUNER, OPTT-404: complete

UHF TUNER - HTT-623 & HTT-627

ELECTRICAL PARTS

Ref. No.	Part Number	Description
C-1	---	TUNING GANG (not replaceable)
C-2	21P65112A06	18 pf 10% 500V cer disc
C-3	20S10123A05	1-5 pf trimmer
C-4	21R134242	2.2 pf ± .1 pf N470 tubular
C-5	21P65112A05	1000 pf feed-thru
C-6	---	TRIM TAB (not furnished)
E-1	48C742970	DIODE, crystal (1N82A)
L-1	1P65112A08	ANTENNA COUPLING ASSEM: incls terminals & R-1
L-2	24P65112A11	COIL, IF output
L-3	---	COIL, injection (not furnished)
Q-1	48P65123A95	TRANSISTOR, special: Fairchild SE-1044

MECHANICAL PARTS

Ref. No.	Part Number	Description
	77P65123A91	UHF TUNER, TT-623 & TT-627: less drive assem: anti-backlash gear, spring & clutch
	44P65127A55	ANTI-BACKLASH GEAR & CLUTCH ASSEM: incls lever tension spring
	43A754070	BUSHING, mtg (UHF tuner)
	15P65112A17	COVER, osc section
	15P65112A18	COVER, tuner
	47P65142A09	DRIVE ASSEM & PLATE: incls mtg screws (HTT-623)
	47P65144A62	DRIVE ASSEM & PLATE: incls mtg screws (HTT-627)
	5K754071	GROMMET, insulating (UHF tuner mtg)
	14P65112A66	INSULATOR, stand-off (transistor base)
	3P65112A67	SCREW, interlock: 6-32 x 3/8" (drive assem mtg)
	41P65112A35	SPRING, cover retaining
	41P65112A36	SPRING, lever tension
	9P65112A33	RECEPTACLE, 1-pin

UHF TUNER - HTT-624

ELECTRICAL PARTS

Ref. No.	Part Number	Description
C-1	---	TUNING GANG (not replaceable)
C-2	21P65144A68	1000 pf feed-thru
C-3	21P65144A69	24 pf feed-thru
C-4	21P65144A70	10 pf N150
E-1	48C742970	DIODE, crystal (1N82A)
Q-1	48P65123A67	TRANSISTOR
L-1	24P65144A66	ANTENNA COUPLING ASSEM: incls terminals, coil, board & R-1
L-2	24P65144A65	IF COIL
L-3	24P65144A64	EMITTER COIL

MECHANICAL PARTS

Ref. No.	Part Number	Description
	77P65144A67	UHF TUNER, TT-624: less drive assem and anti-backlash gear
	44P65127A55	ANTI-BACKLASH GEAR & CLUTCH ASSEM: incls lever tension spring
	15P65144A60	COVER, osc section
	15P65144A59	COVER, tuner
	47P65144A62	DRIVE ASSEM & PLATE: incls mtg screws (less backlash gear)
	14P65144A61	INSULATOR, stand-off (trans base)
	9P65144A71	RECEPTACLE, 1 pin
	3P65112A67	SCREW & LOCKWASHER: 6-32 x 3/8 (drive assem mtg)
	41P65112A35	SPRING, cover retaining
	41P65144A63	SPRING, lever tension

*DENOTES NEW ITEM APPEARING IN ANY LIST FOR FIRST TIME.

SCHEMATIC DIAGRAM - TS-594B-01 THRU C-03

NOTES:

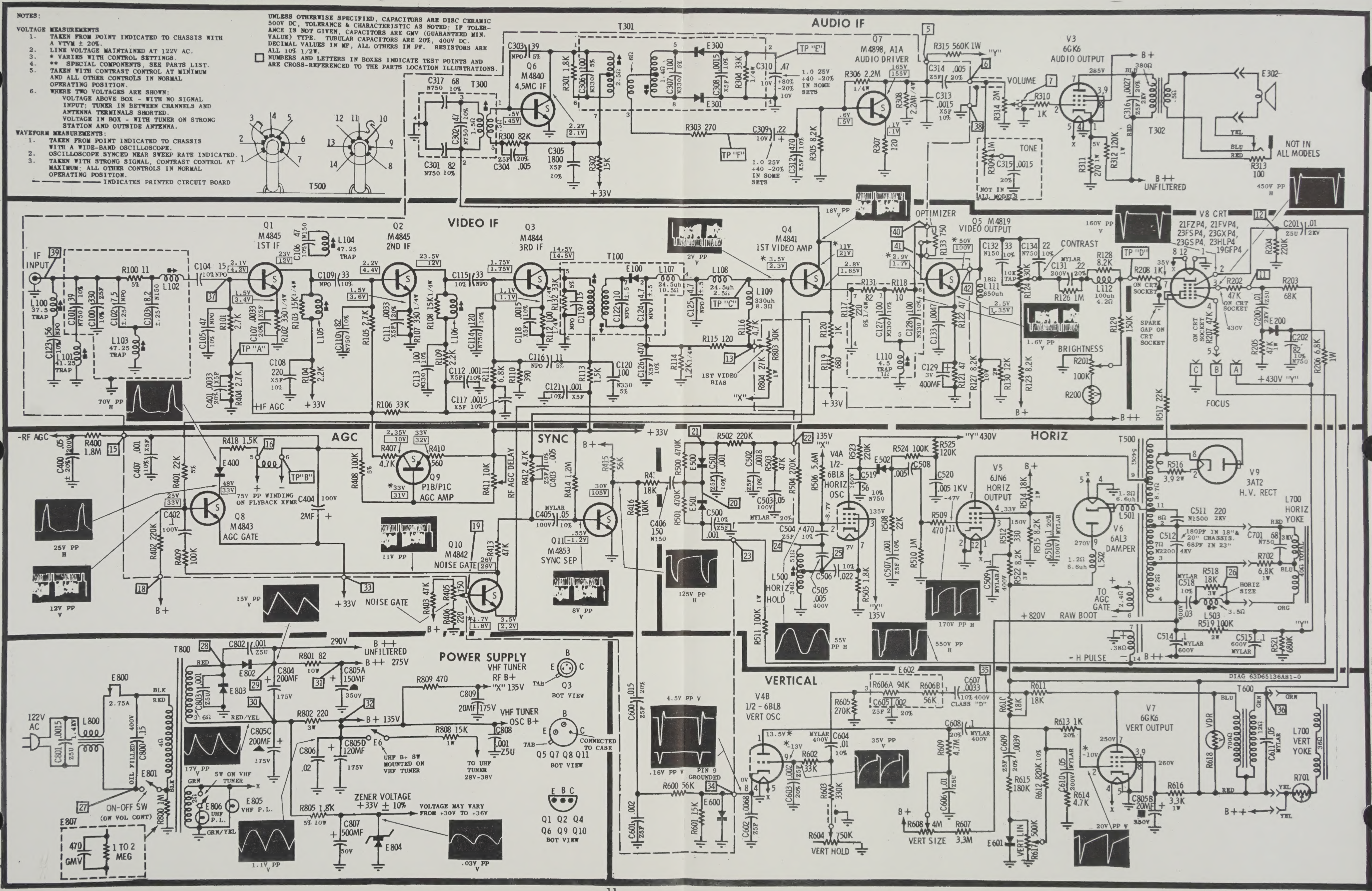
VOLTAGE MEASUREMENTS
1. TAKEN FROM POINT INDICATED TO CHASSIS WITH A VTVM ± 20%.
2. LINE VOLTAGE MAINTAINED AT 122V AC.
3. * VARIES WITH CONTROL SETTINGS.
4. ** SPECIAL COMPONENTS, SEE PARTS LIST.
5. TAKEN WITH CONTRAST CONTROL AT MINIMUM AND ALL OTHER CONTROLS IN NORMAL OPERATING POSITION.
6. WHERE TWO VOLTAGES ARE SHOWN:
   VOLTAGE ABOVE BOX - WITH NO SIGNAL INPUT; TUNER IN BETWEEN CHANNELS AND ANTENNA TERMINALS SHORTED.
   VOLTAGE IN BOX - WITH TUNER ON STRONG STATION AND OUTSIDE ANTENNA.

WAVEFORM MEASUREMENTS:
1. TAKEN FROM POINT INDICATED TO CHASSIS WITH A WIDE-BAND OSCILLOSCOPE.
2. OSCILLOSCOPE SYNCED NEAR SWEEP RATE INDICATED.
3. TAKEN WITH STRONG SIGNAL, CONTRAST CONTROL AT MAXIMUM; ALL OTHER CONTROLS IN NORMAL OPERATING POSITION.

— — — — INDICATES PRINTED CIRCUIT BOARD

UNLESS OTHERWISE SPECIFIED, CAPACITORS ARE DISC CERAMIC 500V DC, TOLERANCE & CHARACTERISTIC AS NOTED; IF TOLERANCE IS NOT GIVEN, CAPACITORS ARE GMV (GUARANTEED MIN. VALUE) TYPE. TUBULAR CAPACITORS ARE 20%, 400V DC. DECIMAL VALUES IN MF, ALL OTHERS IN PF. RESISTORS ARE ALL 10% 1/2W.

☐ NUMBERS AND LETTERS IN BOXES INDICATE TEST POINTS AND ARE CROSS-REFERENCED TO THE PARTS LOCATION ILLUSTRATIONS.

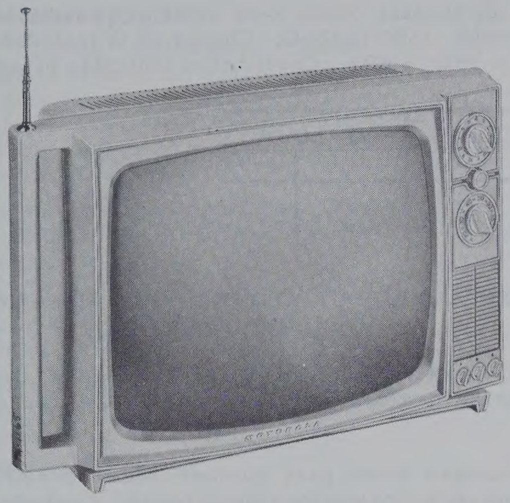

T500
AUDIO IF
T301
Q6 M4840 4.5MC IF
T300
Q7 M4898, A1A AUDIO DRIVER
V3 6GK6 AUDIO OUTPUT
VOLUME
TONE
NOT IN ALL MODELS
T302
E302
B++ UNFILTERED
VIDEO IF
Q1 M4845 1ST IF
Q2 M4845 2ND IF
Q3 M4844 3RD IF
T100
Q4 M4841 1ST VIDEO AMP
OPTIMIZER
Q5 M4819 VIDEO OUTPUT
CONTRAST
BRIGHTNESS
V8 CRT 21FZP4, 21FVP4, 23FSP4, 23GXP4, 23GSP4, 23HLP4, 19GFP4
FOCUS
IF INPUT
1ST VIDEO BIAS
AGC
Q8 M4843 AGC GATE
Q9 P1B/P1C AGC AMP
Q10 M4842 NOISE GATE
RF AGC DELAY
SYNC
Q11 M4853 SYNC SEP
HORIZ
V4A 1/2-6BL8 HORIZ OSC
V5 6JN6 HORIZ OUTPUT
V6 6AL3 DAMPER
V9 3AT2 H.V. RECT
L700 HORIZ YOKE
HORIZ SIZE
L500 HORIZ HOLD
RAW BOOT
POWER SUPPLY
T800
122V AC
ON-OFF SW (ON VOL CONT)
ZENER VOLTAGE +33V ± 10%
VOLTAGE MAY VARY FROM +30V TO +36V
VHF TUNER RF B+
VHF TUNER OSC B+
UHF B+ SW MOUNTED ON VHF TUNER
TO UHF TUNER 28V-38V
Q3 BOT VIEW
Q5 Q7 Q8 Q11 BOT VIEW
Q1 Q2 Q4 Q6 Q9 Q10 BOT VIEW
VERTICAL
V4B 1/2 - 6BL8 VERT OSC
V7 6GK6 VERT OUTPUT
VERT SIZE
VERT HOLD
VERT LIN
L700 VERT YOKE
T600
DIAG 63D65136A81-0

SUPPLEMENT NO. 3
TO TS-597 SERVICE MANUAL,
PART NO. 68P65135A66

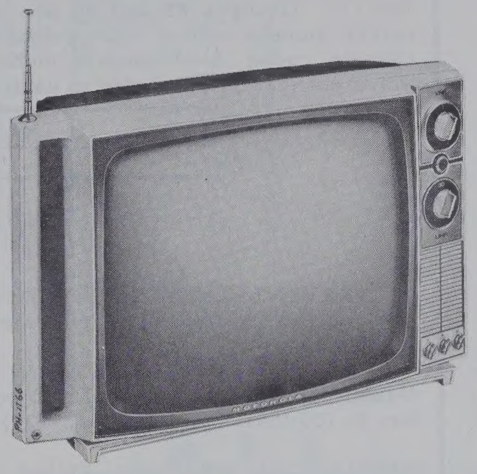
television MANUAL 68P65135A69

CHASSIS TS-597
MODELS BP451C & BP452C

MOTOROLA service manual



MODEL BP451C



MODEL BP452C

GENERAL INFORMATION

This supplement introduces new receivers added to the line since the publication of the original TS-597 service manual.

Complete cabinet parts list, chassis coding changes and UHF tuner service instructions are included in this supplement. For all other information, refer to the original TS-597 service manual.

MODEL BREAKDOWN CHART

MODEL	CHASSIS	VHF TUNER	UHF TUNER	CRT
BP451CN	CTS-597	CMTT-393Y	KTT-622 or KTT-626	16CJP4
BP452CA, CE,CL,CN	NCTS-597	CMTT-393Y	KTT-622 or KTT-626	16CJP4

television MANUAL 68P65135A69
CHASSIS TS-597
MODELS BP451C & BP452C

MOTOROLA INC. 9401 WEST GRAND AVENUE, FRANKLIN PARK, ILLINOIS
PART NO. 68P65135A69 3-67 PRICE 20 CENTS

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CHASSIS CODING CHANGES

<table>
<tr><th>Chassis Coding</th><th>Chassis Coding Changes</th></tr>
<tr><td>BTS-597A-04*</td><td>[1] TO REDUCE HORIZONTAL COLLAPSE: Change C-520 from 150 pf, 20%, Z5F to 100 pf, 20%, Z5F (part number 21S180C18). Change C-500 from 200 pf, 20%, Z5F to 150 pf, 20%, Z5F (part number 21S129730). Change R-508 from 4.7 meg, 10%, 1/2W to 3.3 meg, 10%, 1/2W.

[2] RELIABILITY CHANGE: Noise gate transistor, Q-100, changed from type M4852 to M4853 (part number 48S134853).

[3] TUNER CHANGE: Tuner part number 77D67325A07 replaced by 77D67325B07 (model number of tuner, CMTT-393Y, does not change). See revised schematic diagram in this supplement for new circuit.

*NOTE: Changes #1 and #2 are included in chassis coded A-03 which are used in receiver models with a -"Q" suffix, for example: 16BP76BN-Q. Change #3 is included in chassis coded A-04 used in models with a -"Q" suffix. Chart below indicates by an X which changes are included in each chassis.

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<tr><th>CHANGE</th><th>A-03</th><th>A-04</th><th>A-03</th><th>A-04</th></tr>
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<tr><td>BTS-597A-05</td><td>TO PREVENT RADIATION FROM HORIZONTAL OUTPUT CIRCUIT: Radiation shield added at rear of flyback transformer.</td></tr>
<tr><td>BTS-597A-06</td><td>TO PREVENT REGENERATION IN VIDEO IF: B+lead (blue wire jumper) to 3rd IF stage divided into two sections and mid-point bypassed to ground with 1000 pf, 20%, Z5F capacitor, C-125 (part number 21S129821).</td></tr>
<tr><td>BTS-597A-07</td><td>MECHANICAL CHANGE: Etched board changed from part number 84C68110A02 to 84C68110A03 to accommodate three additional capacitors on top side of board. Capacitors C-203, C-520 and C-125 relocated from bottom to top of board.</td></tr>
<tr><td>BTS-597A-08</td><td>RELIABILITY CHANGE: B+ dropping resistor, R-803, changed from 3.3K, 7 watt, to 3K, 7 watt, part number 17S733877 to raise B+ voltage and increase reliability of neon pilot lights.</td></tr>
<tr><td>BTS-597A-09</td><td>RELIABILITY CHANGE: Added two spark gaps, part number 80C68147A01, to prevent damage to power rectifiers in the event of an arc in the high voltage transformer or CRT. One gap is located on the high voltage transformer and connected from the negative AGC pluse winding to ground. The other gap is located at the B++ focus lead tap and is connected from B++ to ground.</td></tr>
<tr><td>BTS-597A-10</td><td>TO REDUCE VHF OSCILLATOR RADIATION: C-126 added on tuner - B+ to chassis.</td></tr>
<tr><td>No Code Change</td><td>TO INCREASE RELIABILITY: R-520 changed to 2 watt.</td></tr>
<tr><td>No Code Change</td><td>TO IMPROVE HORIZONTAL SCAN: C-511 changed to 180 pf, 10%, N2200, 4Kv.</td></tr>
<tr><td>BTS-597A-11</td><td>TO INCREASE RELIABILITY: Spark gap and dummy lug deleted in CRT socket. R-208, 47K, 1/2 watt resistor added on outside of socket for arc protection.</td></tr>
<tr><td>BTS-597A-12</td><td>TO INCREASE RELIABILITY: Spark gap added in A-09 chassis changed to part number 80C68147A04.</td></tr>
</table>

UHF TUNER ALIGNMENT - KTT-626

The UHF output signal is coupled to VHF tuner with inter-connecting cables. B+ voltage of the UHF tuner is obtained by an inter-connecting lead between the UHF tuner and VHF tuner.

The tuner is factory pre-aligned. Alignment is not necessary or recommended.

The UHF tuner components are rugged mechanisms and unless obvious damage or tampering has occured, it should only be necessary to adjust the mixer crystal current for proper operating limits.

EQUIPMENT REQUIRED

UHF Sweep Generator: Tel-instrument type 1211, 1211S having a 300 ohm balanced matching pad such as the RCA WG-224, WG-223, TIC-1655 or equivalent instrument. Internal marker not used.

External Marker Generator: Output .1 volt or more; fixed frequency 44Mc; accuracy 1%.

Power Supply: TV chassis or other shop supply (135V DC thru a 15K resistor).

Milliammeter: 0-5 Ma range (20 ohms for total resistance of injection metering circuit).

TUNER CONNECTIONS

CAUTION: It is imperative that a good ground connection exist between the power source and the tuner housing before applying power. This procedure will prevent any possible damage or failure of the mixer crystal within the tuner.

1. Connect the UHF tuner B+ tie point (C-5) to the VHF tuners "UHF B+ T.P." through the series resistor specified in the respective UHF tuners schematic diagram.

PRE-ALIGNMENT NOTES

1. Disable the horizontal output section by disconnecting the screen grid dropping resistor.

2. Use Figures #1 and #2 for test equipment connections and adjustment locations.

3. Cover must be in place during adjustment.

4. Allow approximately 15 minutes warm-up time before adjustment.

5. Connect UHF sweep generator thru matching pad to tuner antenna plugs.

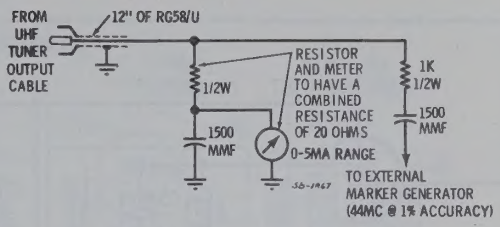
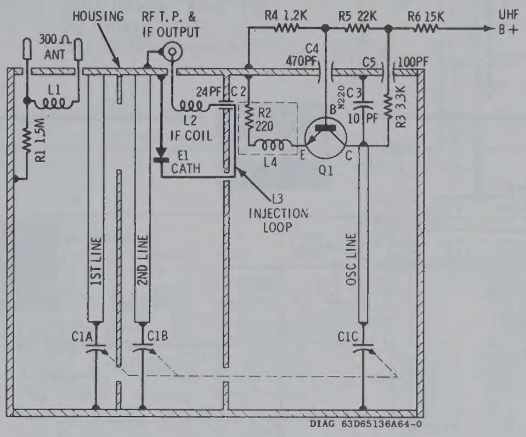

FROM UHF TUNER OUTPUT CABLE
12" OF RG58/U
1/2W
1500 MMF
RESISTOR AND METER TO HAVE A COMBINED RESISTANCE OF 20 OHMS
0-5MA RANGE
1K 1/2W
1500 MMF
TO EXTERNAL MARKER GENERATOR (44MC @ 1% ACCURACY)
5b-1967

FIGURE 1 - TEST EQUIPMENT CONNECTIONS


HOUSING
RF T.P. & IF OUTPUT
R4 1.2K
R5 22K
R6 15K
UHF B+
300Ω ANT
C4 470PF
C5 100PF
L1
R1 1.5M
24PF
C2
L2 IF COIL
E1 CATH
R2 220
L4
B
E
C
Q1
N220
C3 10 PF
R3 3.3K
L3 INJECTION LOOP
1ST LINE
2ND LINE
OSC LINE
C1A
C1B
C1C
DIAG 63D65136A64-0

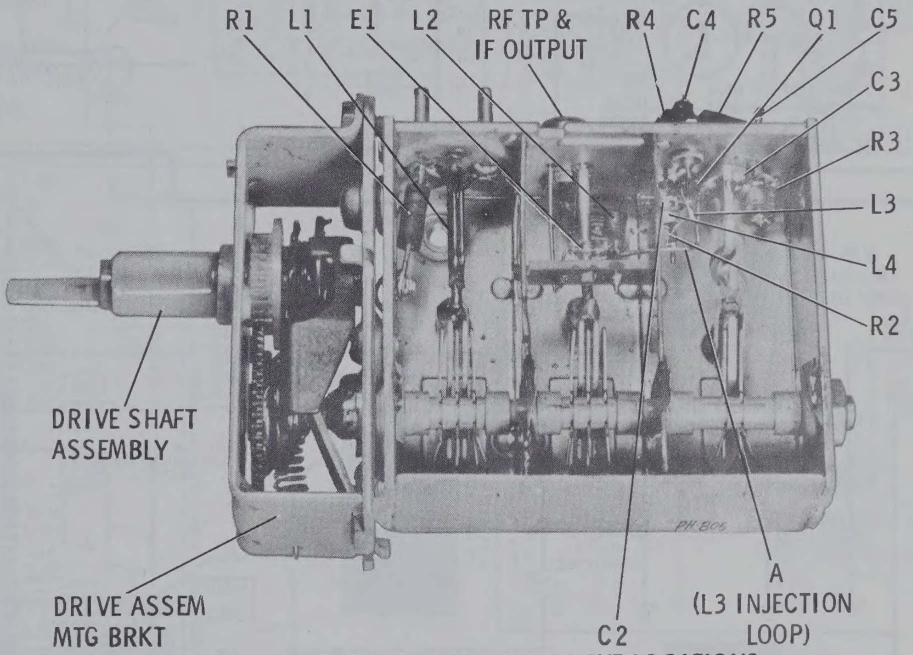

R1
L1
E1
L2
RF TP & IF OUTPUT
R4
C4
R5
Q1
C5
C3
R3
L3
L4
R2
DRIVE SHAFT ASSEMBLY
DRIVE ASSEM MTG BRKT
C2
A (L3 INJECTION LOOP)
PH 806

FIGURE 2 - UHF TUNER KTT-626 COMPONENT LOCATIONS

UHF TUNER ALIGNMENT PROCEDURE

IMPORTANT NOTE: It is NOT recommended that any additional adjustments be made other than those given below, otherwise, proper adjustment may be impossible. Remove oscillator cover; adjustments are accessible through opening in oscillator cover.

STEP	TUNER KNOB DRIVE SHAFT	SWEEP GENERATOR	INDICATOR	ADJUST	ADJUST FOR AND/OR REMARKS
1.	Fully counter-clockwise (tuning gang fully open)	Sweep at 900Mc and external marker set at 44Mc	*Milliammeter (see Figure #1)	A	Bend loop in or out for a reading of .5 to 4.0 milliamperes.
2.	Turn slowly clockwise across entire band to stop	Track with tuner	"	A	Repeat Step #1 until crystal current is within limits of .5 to 4.0 Ma across band (1.0 to 2.0Ma is optimum).

*Meter to be used for crystal current check should have a 0-5 milliampere range and the total meter circuit resistance should be 20 ohms.

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[2] RELIABILITY CHANGE: Noise gate transistor, Q-100, changed from type M4852 to M4853 (part number 48S134853).
[3] TUNER CHANGE: Tuner part number 77D67325A07 replaced by 77D67325B07 (model number of tuner, CMTT-393Y, does not change). See revised schematic diagram in this supplement for new circuit.
*NOTE: Changes #1 and #2 are included in chassis coded A-03 which are used in receiver models with a -"Q" suffix, for example: 16BP76BN-Q. Change #3 is included in chassis coded A-04 used in models with a -"Q" suffix. Chart below indicates by an X which changes are included in each chassis.
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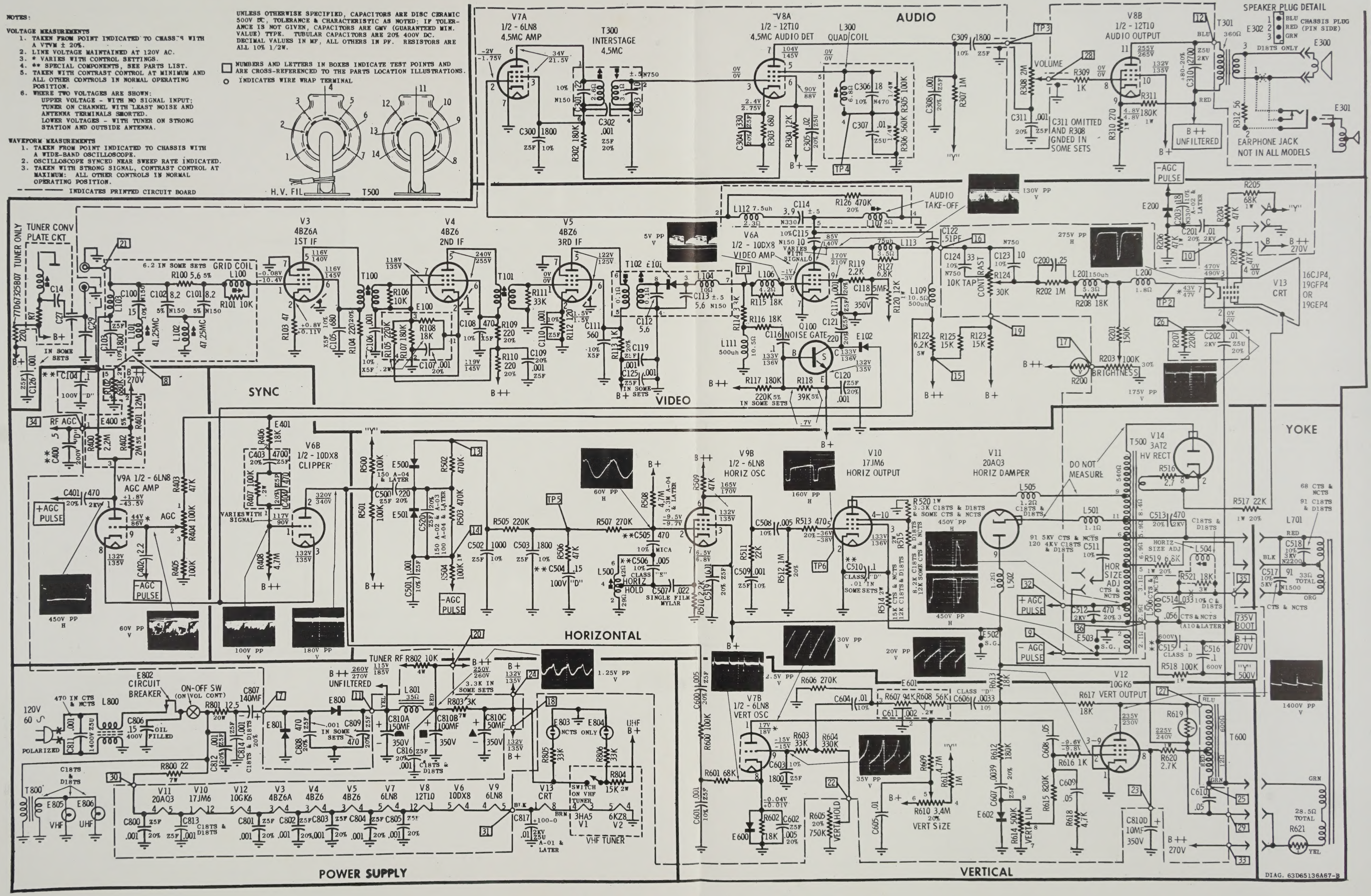
SCHEMATIC DIAGRAM - C18TS, D18TS & TS-597A-04 THRU A-12



NOTES:

VOLTAGE MEASUREMENTS
1. TAKEN FROM POINT INDICATED TO CHASSIS WITH A VTVM ± 20%.
2. LINE VOLTAGE MAINTAINED AT 120V AC.
3. * VARIES WITH CONTROL SETTINGS.
4. ** SPECIAL COMPONENTS, SEE PARTS LIST.
5. TAKEN WITH CONTRAST CONTROL AT MINIMUM AND ALL OTHER CONTROLS IN NORMAL OPERATING POSITION.
6. WHERE TWO VOLTAGES ARE SHOWN:
   UPPER VOLTAGE - WITH NO SIGNAL INPUT; TUNER ON CHANNEL WITH LEAST NOISE AND ANTENNA TERMINALS SHORTED.
   LOWER VOLTAGES - WITH TUNER ON STRONG STATION AND OUTSIDE ANTENNA.

WAVEFORM MEASUREMENTS
1. TAKEN FROM POINT INDICATED TO CHASSIS WITH A WIDE-BAND OSCILLOSCOPE.
2. OSCILLOSCOPE SYNCED NEAR SWEEP RATE INDICATED.
3. TAKEN WITH STRONG SIGNAL, CONTRAST CONTROL AT MAXIMUM: ALL OTHER CONTROLS IN NORMAL OPERATING POSITION.

- — — INDICATES PRINTED CIRCUIT BOARD

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☐ NUMBERS AND LETTERS IN BOXES INDICATE TEST POINTS AND ARE CROSS-REFERENCED TO THE PARTS LOCATION ILLUSTRATIONS.

○ INDICATES WIRE WRAP TERMINAL

H.V. FIL
T500
AUDIO
V7A 1/2 - 6LN8 4.5MC AMP
T300 INTERSTAGE 4.5MC
V8A 1/2 - 12T10 4.5MC AUDIO DET
L300 QUAD COIL
VOLUME
V8B 1/2 - 12T10 AUDIO OUTPUT
T301
SPEAKER PLUG DETAIL
E302
BLU
RED
GRN
CHASSIS PLUG (PIN SIDE)
D18TS ONLY
E300
E301
EARPHONE JACK NOT IN ALL MODELS
C311 OMITTED AND R308 GNDED IN SOME SETS
B++ UNFILTERED
-AGC PULSE
TUNER CONV PLATE CKT
77D67325B07 TUNER ONLY
V3 4BZ6A 1ST IF
V4 4BZ6 2ND IF
V5 4BZ6 3RD IF
GRID COIL
6.2 IN SOME SETS
41.25MC
47.25MC
T100
T101
T102
E100
V6A 1/2 - 10DX8 VIDEO AMP
AUDIO TAKE-OFF
NOISE GATE
Q100
E102
VIDEO
CONTRAST
10K TAP
BRIGHTNESS
V13 CRT 16CJP4, 19GFP4 OR 19GEP4
E200
SYNC
RF AGC
E400
V9A 1/2 - 6LN8 AGC AMP
AGC
+AGC PULSE
V6B 1/2 - 10DX8 CLIPPER
VARIES WITH SIGNAL
E401
E500
E501
HORIZONTAL
HORIZ HOLD
SINGLE FILM MYLAR
V9B 1/2 - 6LN8 HORIZ OSC
V10 17JM6 HORIZ OUTPUT
V11 20AQ3 HORIZ DAMPER
V14 3AT2 HV RECT
DO NOT MEASURE
HOR SIZE ADJ
HORIZ SIZE ADJ
YOKE
L701
BOOT
E502
E503
POWER SUPPLY
120V 60 ∿
POLARIZED
L800
E802 CIRCUIT BREAKER
ON-OFF SW (ON VOL CONT)
OIL FILLED
E800
E801
B++ UNFILTERED
TUNER RF
T800
E805 VHF
E806 UHF
V11 20AQ3
V10 17JM6
V12 10GK6
V3 4BZ6A
V4 4BZ6
V5 4BZ6
V7 6LN8
V8 12T10
V6 10DX8
V9 6LN8
V13 CRT
3HA5 V1
6KZ8 V2
VHF TUNER
SWITCH ON VHF TUNER
E803
E804 NCTS ONLY
UHF B+
VERTICAL
V7B 1/2 - 6LN8 VERT OSC
VERT HOLD
VERT SIZE
VERT LIN
V12 10GK6 VERT OUTPUT
T600
E600
E601
E602
130V PP V
275V PP H
175V PP V
5V PP V
450V PP H
60V PP V
100V PP V
180V PP V
60V PP H
160V PP H
450V PP H
30V PP V
20V PP V
1400V PP V
1.25V PP V
2.5V PP V
35V PP V
DIAG. 63D65136A67-B

REPLACEMENT PARTS LIST

Ref. No.	Part Number	Description
		ELECTRICAL PARTS
C-125	21S129821	CAPACITOR, DISC: 1000 pf 20% 500V Z5F
C-126	21S410127	CAPACITOR, DISC: 1000 pf 20% 500V Z5F
C-203	21S129733	CAPACITOR DISC: 18 pf 10% 500V N330
C-500	21S180C18	CAPACITOR DISC: 100 pf 20% 500V Z5F
C-511	21S180A88	CAPACITOR DISC: 180 pf 10% 4KV N2200
C-514	8S10212A14	CAPACITOR, .056 mf 10% 630V
C-520	21S180C18	CAPACITOR, DISC: 100 pf 20% 500V Z5F
C-811	21S134118	CAPACITOR, DISC: .001 mf GMV 1.4KV Z5U
R-803	17S733877	W.W. Resis. 3K 10% 7W
L-506	24D65698A07	COIL, horizontal linearity
L-701	24D67621B03	DEF. YOKE
MISCELLANEOUS ELECTRICAL PARTS		
	9C67191A08	SOCKET, CRT: (USE 9P65146A57)
	30C66175A62	WIRE, 30-1/2": high voltage filament
	24C67284A01	COIL, balum: monopole antenna
E-502, E-503	80C68147A04	SPARK GAP

CABINET PARTS

Ref. No.	Part Number	Description
MODEL BP451CN		
	85P65133A40	ANTENNA, UHF: "bow-tie"
	1C67665A01	ANTENNA, VHF: tube, rod & ball
	*75C66381A16	BUMPER: CRT mtg (8 req'd)
	*16E68015A03	CABINET, front: plastic; white
	42A65602A01	CLIP, grounding: res cap to CRT shield mtg
	43B67666A01	COLLAR, monopole ant mtg
	30S183A02	CORD, AC line: incls retaining clip
	*15P65145A98	COVER, cabinet back: beige; plastic; incl armite ins; less line cord
	*34D68069A05	DIAL, UHF
	*36D67685A13	KNOB, brightness, vertical hold & contrast
	*36D68066A04	KNOB, fine tuning
	*36C68376A01	KNOB, on-off volume
	*36D68062A10	KNOB, UHF channel selector
	*1D68065A05	KNOB, VHF channel selector and dial assembly
	2S134218	NUT, hex: 1/4-32 (earphone receptacle mtg)
	42C67092A03	RETAINER, wire: CRT
	3S132019	SCREW, tpg: #8-18 x 2-3/4": CRT retainer
	14D67172A11	SHIELD, armite: back cover; behind cord retainer
	1C67859A01	SLEEVE & SPRING ASSEM: monopole ant mtg
	50D67688A02	SPEAKER: 3" PM
	2C65722A03	SPEEDNUT: clip-on: CRT retainer
	42B68048A01	STRAP, CRT mtg: secures CRT to cabinet front; 4 req'd
	29A731948	TERMINAL, open ring: res cap to tuner brkt mtg
MODELS BP452CA, E, L, N		
	85P65133A40	ANTENNA, UHF: "bow-tie"
	1C67665A01	ANTENNA, VHF: tube, rod & ball
	75C66381A16	BUMPER: CRT mtg (8 req'd)
	*16P65145A99	CABINET, front: plastic; white; incl overlays
	42A65602A01	CLIP, grounding: res cap to CRT shield mtg
	43B67666A01	COLLAR, monopole ant mtg
	30S183A02	CORD, AC line: incls retaining clip
	*15P65146A50	COVER, cabinet back: gray; plastic; incl armite ins; less line cord (BP452CA)
	*15P65146A51	COVER, cabinet back; charcoal; plastic; incl armite ins; less line cord (BP452CE)
	*15P65146A52	COVER, cabinet back: blue; plastic; incl armite ins; less line cord (BP452CL)
	*15P65146A53	COVER, cabinet back: beige; plastic; incl armite ins; less line cord (BP452CN)
	*34D68069A04	DIAL, UHF
	50D67734A01	EARPHONE
	*36D67685A12	KNOB, brightness, vertical hold and contrast
	36D68066A04	KNOB, fine tuning
	*36C68376A02	KNOB, on-off-volume
	*36D68062A07	KNOB, UHF channel selector
	*1D68065A04	KNOB, VHF channel selector and dial assembly
	65C66771A03	LAMP, dial indicator: neon
	2S134218	NUT, hex: 1/4-32 (earphone receptacle mtg)
	*13C68374A02	OVERLAY, control panel: UHF
	*13C68374A01	OVERLAY, control panel: VHF
	42C67092A03	RETAINER, wire: CRT
	3S132019	SCREW, tpg: #8-18 x 2-3/4: CRT retainer
	14D67172A11	SHIELD, armite: back cover; behind cord retainer
	1C67859A01	SLEEVE AND SPRING ASSEM: monopole ant mtg
	50D67688A02	SPEAKER: 3" PM
	2C65722A03	SPEEDNUT, clip-on: CRT retainer
	42B68048A01	STRAP, CRT mtg: secures CRT to cabinet front; 4 req'd
	29A731948	TERMINAL, open ring: res cap to tuner brkt mtg
	*1V66589A81	WINDOW, channel number: incl term strip & light brkt

UHF TUNER - KTT-626

Ref. No.	Part Number	Description
C-1	---	TUNING GANG (not replaceable)
C-2	21P65144A76	24 pf feed-thru
C-3	21P65144A77	10 pf
C-4	21P65144A78	470 pf feed-thru
C-5	21P65144A79	100 pf feed-thru
E-1	48P65112A73	DIODE, mixer
L-2	24P65144A74	IF COIL
L-4	24P65144A73	EMITTER COIL
Q-1	48P65144A72	TRANSISTOR (S1019)
	7P65112A74	BRACKET, drive assembly mtg
	47P65144A07	DRIVE SHAFT ASSEMBLY: less mtg brkt
	77D67691A05	UHF TUNER, KTT-626: complete
REVISIONS		
E-102	48S191A05	RECTIFIER, silicon: noise gate (replaces 48S191A01)
E-200	48D67120A09	DIODE, horz blanking (replaces 48D67120A02)
E-801		Is a power rectifier not a res-cap
L-112		Should be: L-201 (part number 24D68002A19)
L-508		Should read: L-502 (part number 24C66772A03)

*DENOTES NEW ITEM APPEARING IN ANY LIST FOR FIRST TIME.

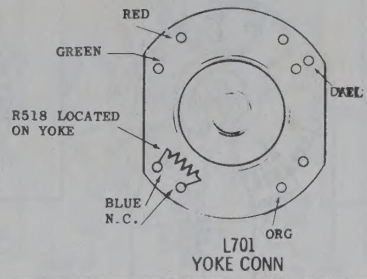
NOTES:

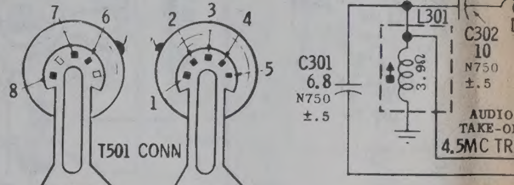
VOLTAGE MEASUREMENTS
1. TAKEN FROM POINT INDICATED TO CHASSIS WITH A VTVM ±20%.
2. LINE VOLTAGE MAINTAINED AT 120V AC.
3. TAKEN WITH CONTRAST CONTROL AS MINIMUM AND ALL OTHER CONTROLS IN NORMAL OPERATING POSITION WITH NO SIGNAL INPUT.
4. TUNER ON CHANNEL 13 OR CHANNEL OF LEAST NOISE WITH ANTENNA TERMINALS SHORTED.

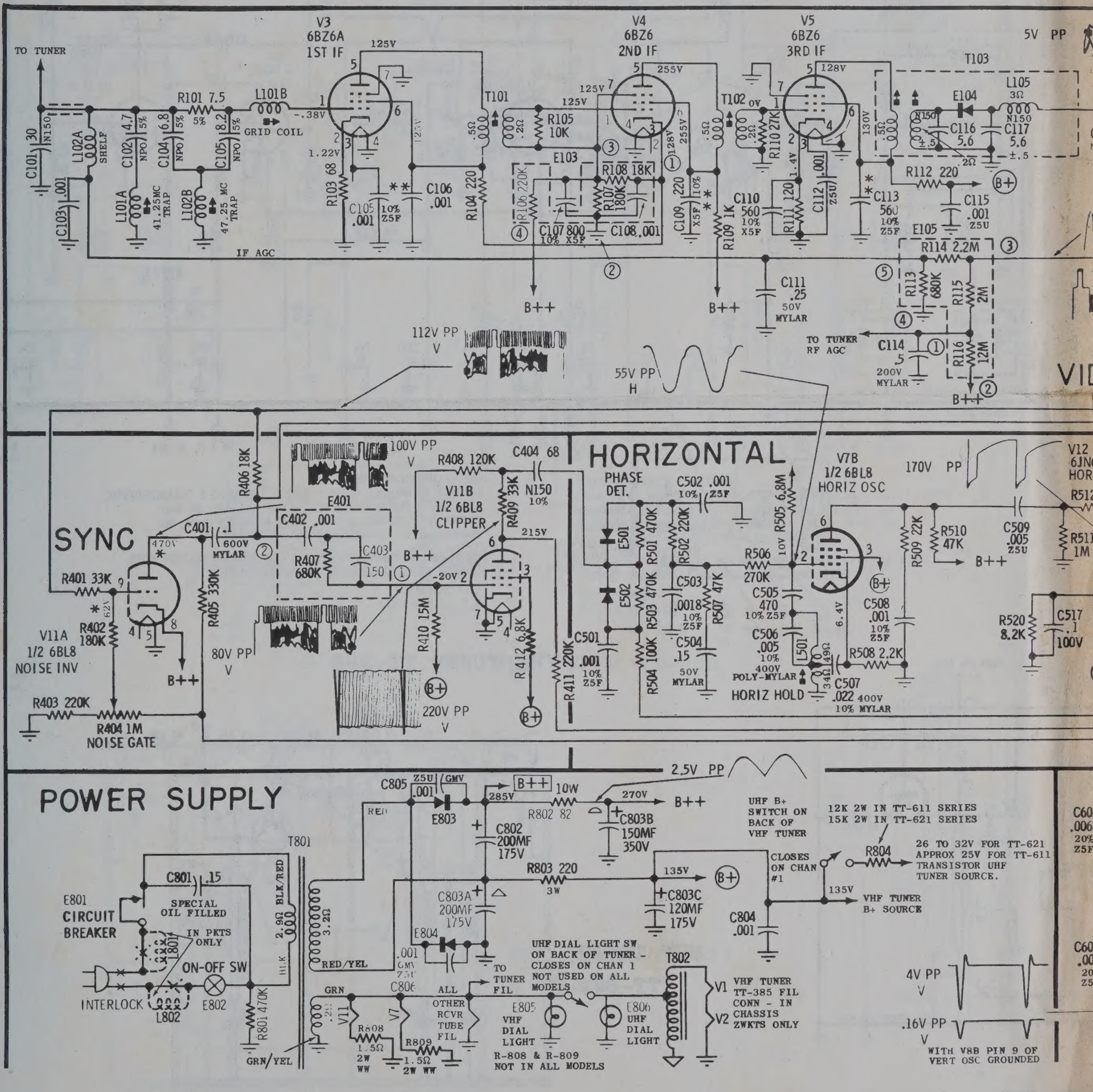
WAVEFORM MEASUREMENTS
1. TAKEN FROM POINT INDICATED TO CHASSIS WITH A WIDE-BAND OSCILLOSCOPE.
2. OSCILLOSCOPE SYNCED NEAR SWEEP RATE INDICATED.
3. TAKEN WITH STRONG SIGNAL. CONTRAST CONTROL AT MAXIMUM. ALL OTHER CONTROLS IN NORMAL OPERATING POSITION.

* INDICATES VOLTAGE VARIES WITH CONTROL SETTINGS.
** INDICATES SPECIAL COMPONENTS. SEE REPLACEMENT PARTS LIST FOR PROPER REPLACEMENT PART NUMBER.

UNLESS OTHERWISE SPECIFIED CAPACITORS ARE DISC CERAMIC 500V DC TOLERANCE & CHARACTERISTIC AS NOTED: IF TOLERANCE IS NOT GIVEN CAPACITORS ARE GMV (GUARANTEED MIN VALUE) TYPE TUBULAR CAPACITORS ARE 20% 400V DC. DECIMAL VALUES IN MF ALL OTHERS IN MMF RESISTORS ARE ALL 10% 1/2 WATT.


RED
GREEN
DAEL
R518 LOCATED ON YOKE
BLUE N.C.
ORG
L701 YOKE CONN


7
6
8
2
3
4
5
1
T501 CONN
L301
C301 6.8 N750 ±.5
C302 10 N750 ±.5
3.9Ω
AUDIO TAKE-O
4.5MC TR


TO TUNER
V3 6BZ6A 1ST IF
V4 6BZ6 2ND IF
V5 6BZ6 3RD IF
125V
255V
128V
T101
T102
T103
5V PP
C101 30 N150
C102 4.7 NPO 5%
C104 6.8 NPO 5%
C105 8.2 NPO 5%
C103 .001
L102A SHELF
L101A 41.25MC TRAP
L102B 47.25 MC TRAP
R101 7.5 5%
L101B GRID COIL
-.38V
1.22V
R103 68
C105 .001
C106 .001
10% Z5F
R104 220
R105 10K
E103
R106 220K
R108 18K
R107 180K
C107 800 10% X5F
C108 .001
C109 220 10% X5F
R109 1K
R110 27K
C110 560 10% X5F
R111 120
C112 .001 Z5U
1.4V
130V
E104
L105 3Ω
C116 5.6 N150 ±.5
C117 5.6 N150 ±.5
R112 220
C113 560 10% Z5F
C115 .001 Z5U
E105
R114 2.2M
R113 680K
R115 2M
R116 12M
C111 .25 50V MYLAR
C114 .5 200V MYLAR
TO TUNER RF AGC
IF AGC
B++
B+
VID
112V PP V
55V PP H
100V PP V
80V PP V
220V PP V
170V PP
SYNC
HORIZONTAL
PHASE DET.
V11A 1/2 6BL8 NOISE INV
V11B 1/2 6BL8 CLIPPER
V7B 1/2 6BL8 HORIZ OSC
V12 6JN HOR
R401 33K
R402 180K
R403 220K
R404 1M NOISE GATE
R405 330K
R406 18K
C401 .1 600V MYLAR
C402 .001
R407 680K
C403 150
E401
R408 120K
C404 68 N150 10%
R409 33K
R410 15M
R412 6.8K
R411 220K
215V
-20V
470V
62V
E501
E502
C501 .001 10% Z5F
R501 470K
R502 220K
R503 470K
R504 100K
C502 .001 10% Z5F
C503 .0018 10% Z5F
C504 .15 50V MYLAR
R505 6.8M
R506 270K
R507 47K
C505 470 10% Z5F
C506 .005 10% 400V POLY-MYLAR
L501
HORIZ HOLD
C507 .022 400V 10% MYLAR
R508 2.2K
C508 .001 10% Z5F
R509 22K
R510 47K
C509 .005 Z5U
R511 1M
R512
R520 8.2K
C517 .1 100V
10V
6.4V
POWER SUPPLY
2.5V PP
C805 Z5U .001 GMV
E803
285V
R802 82 10W
270V
C803B 150MF 350V
C802 200MF 175V
T801
R803 220 3W
135V
C803A 200MF 175V
C803C 120MF 175V
C804 .001
E804
E801 CIRCUIT BREAKER
C801 .15 SPECIAL OIL FILLED
IN PKTS ONLY
L801
ON-OFF SW
INTERLOCK
L802
E802
R801 470K
2.9Ω BLK/RED
3.2Ω
BLK
RED
RED/YEL
GRN
GRN/YEL
.001 GMV Z5U
C806
V11
V7
R808 1.5Ω 2W WW
R809 1.5Ω 2W WW
ALL OTHER RCVR TUBE FIL
TO TUNER FIL
UHF DIAL LIGHT SW ON BACK OF TUNER - CLOSES ON CHAN 1 NOT USED ON ALL MODELS
E805 VHF DIAL LIGHT
E806 UHF DIAL LIGHT
R-808 & R-809 NOT IN ALL MODELS
T802
V1
V2
VHF TUNER TT-385 FIL CONN - IN CHASSIS ZWKTS ONLY
UHF B+ SWITCH ON BACK OF VHF TUNER
CLOSES ON CHAN #1
12K 2W IN TT-611 SERIES
15K 2W IN TT-621 SERIES
R804
26 TO 32V FOR TT-621 APPROX 25V FOR TT-611 TRANSISTOR UHF TUNER SOURCE.
VHF TUNER B+ SOURCE
4V PP V
.16V PP V
WITH V8B PIN 9 OF VERT OSC GROUNDED

MOTOROLA TV CHASSIS TS-589C ADVANCE SCHEMATIC DIA

REPLACEMENT PARTS LIST

ELECTRICAL PARTS

Ref. No.	Part Number	Description
C-125	21S129821	CAPACITOR, DISC: 1000 pf 20% 500V Z5F
C-126	21S410127	CAPACITOR, DISC: 1000 pf 20% 500V Z5F
C-203	21S129733	CAPACITOR DISC: 18 pf 10% 500V N330
C-500	21S180C18	CAPACITOR DISC: 100 pf 20% 500V Z5F
C-511	21S180A88	CAPACITOR DISC: 180 pf 10% 4KV N2200
C-514	8S10212A14	CAPACITOR, .056 mf 10% 630V
C-520	21S180C18	CAPACITOR, DISC: 100 pf 20% 500V Z5F
C-811	21S134118	CAPACITOR, DISC: .001 mf GMV 1.4KV Z5U
R-803	17S733877	W.W. Resis. 3K 10% 7W
L-506	24D65698A07	COIL, horizontal linearity
L-701	24D67621B03	DEF. YOKE

MISCELLANEOUS ELECTRICAL PARTS

Ref. No.	Part Number	Description
	9C67191A08	SOCKET, CRT: (USE 9P65146A57)
	30C66175A62	WIRE, 30-1/2": high voltage filament
	24C67284A01	COIL, balum: monopole antenna
E-502, E-503	80C68147A04	SPARK GAP

CABINET PARTS

MODEL BP451CN

Ref. No.	Part Number	Description
	85P65133A40	ANTENNA, UHF: "bow-tie"
	1C67665A01	ANTENNA, VHF: tube, rod & ball
	*75C66381A16	BUMPER: CRT mtg (8 req'd)
	*16E68015A03	CABINET, front: plastic; white
	42A65602A01	CLIP, grounding: res cap to CRT shield mtg
	43B67666A01	COLLAR, monopole ant mtg
	30S183A02	CORD, AC line: incls retaining clip
	*15P65145A98	COVER, cabinet back: beige; plastic; incl armite ins; less line cord
	*34D68069A05	DIAL, UHF
	*36D67685A13	KNOB, brightness, vertical hold & contrast
	*36D68066A04	KNOB, fine tuning
	*36C68376A01	KNOB, on-off volume
	*36D68062A10	KNOB, UHF channel selector
	*1D68065A05	KNOB, VHF channel selector and dial assembly
	2S134218	NUT, hex: 1/4-32 (earphone receptacle mtg)
	42C67092A03	RETAINER, wire: CRT
	3S132019	SCREW, tpg: #8-18 x 2-3/4": CRT retainer
	14D67172A11	SHIELD, armite: back cover; behind cord retainer
	1C67859A01	SLEEVE & SPRING ASSEM: monopole ant mtg
	50D67688A02	SPEAKER: 3" PM
	2C65722A03	SPEEDNUT: clip-on: CRT retainer
	42B68048A01	STRAP, CRT mtg: secures CRT to cabinet front; 4 req'd
	29A731948	TERMINAL, open ring: res cap to tuner brkt mtg

MODELS BP452CA, E, L, N

Ref. No.	Part Number	Description
	85P65133A40	ANTENNA, UHF: "bow-tie"
	1C67665A01	ANTENNA, VHF: tube, rod & ball
	75C66381A16	BUMPER: CRT mtg (8 req'd)
	*16P65145A99	CABINET, front: plastic; white; incl overlays
	42A65602A01	CLIP, grounding: res cap to CRT shield mtg
	43B67666A01	COLLAR, monopole ant mtg
	30S183A02	CORD, AC line: incls retaining clip
	*15P65146A50	COVER, cabinet back: gray; plastic; incl armite ins; less line cord (BP452CA)
	*15P65146A51	COVER, cabinet back; charcoal; plastic; incl armite ins; less line cord (BP452CE)
	*15P65146A52	COVER, cabinet back: blue; plastic; incl armite ins; less line cord (BP452CL)
	*15P65146A53	COVER, cabinet back: beige; plastic; incl armite ins; less line cord (BP452CN)
	*34D68069A04	DIAL, UHF
	50D67734A01	EARPHONE
	*36D67685A12	KNOB, brightness, vertical hold and contrast
	36D68066A04	KNOB, fine tuning
	*36C68376A02	KNOB, on-off-volume
	*36D68062A07	KNOB, UHF channel selector
	*1D68065A04	KNOB, VHF channel selector and dial assembly
	65C66771A03	LAMP, dial indicator: neon
	2S134218	NUT, hex: 1/4-32 (earphone receptacle mtg)
	*13C68374A02	OVERLAY, control panel: UHF
	*13C68374A01	OVERLAY, control panel: VHF
	42C67092A03	RETAINER, wire: CRT
	3S132019	SCREW, tpg: #8-18 x 2-3/4: CRT retainer
	14D67172A11	SHIELD, armite: back cover; behind cord retainer
	1C67859A01	SLEEVE AND SPRING ASSEM: monopole ant mtg
	50D67688A02	SPEAKER: 3" PM
	2C65722A03	SPEEDNUT, clip-on: CRT retainer
	42B68048A01	STRAP, CRT mtg: secures CRT to cabinet front; 4 req'd
	29A731948	TERMINAL, open ring: res cap to tuner brkt mtg
	*1V66589A81	WINDOW, channel number: incl term strip & light brkt

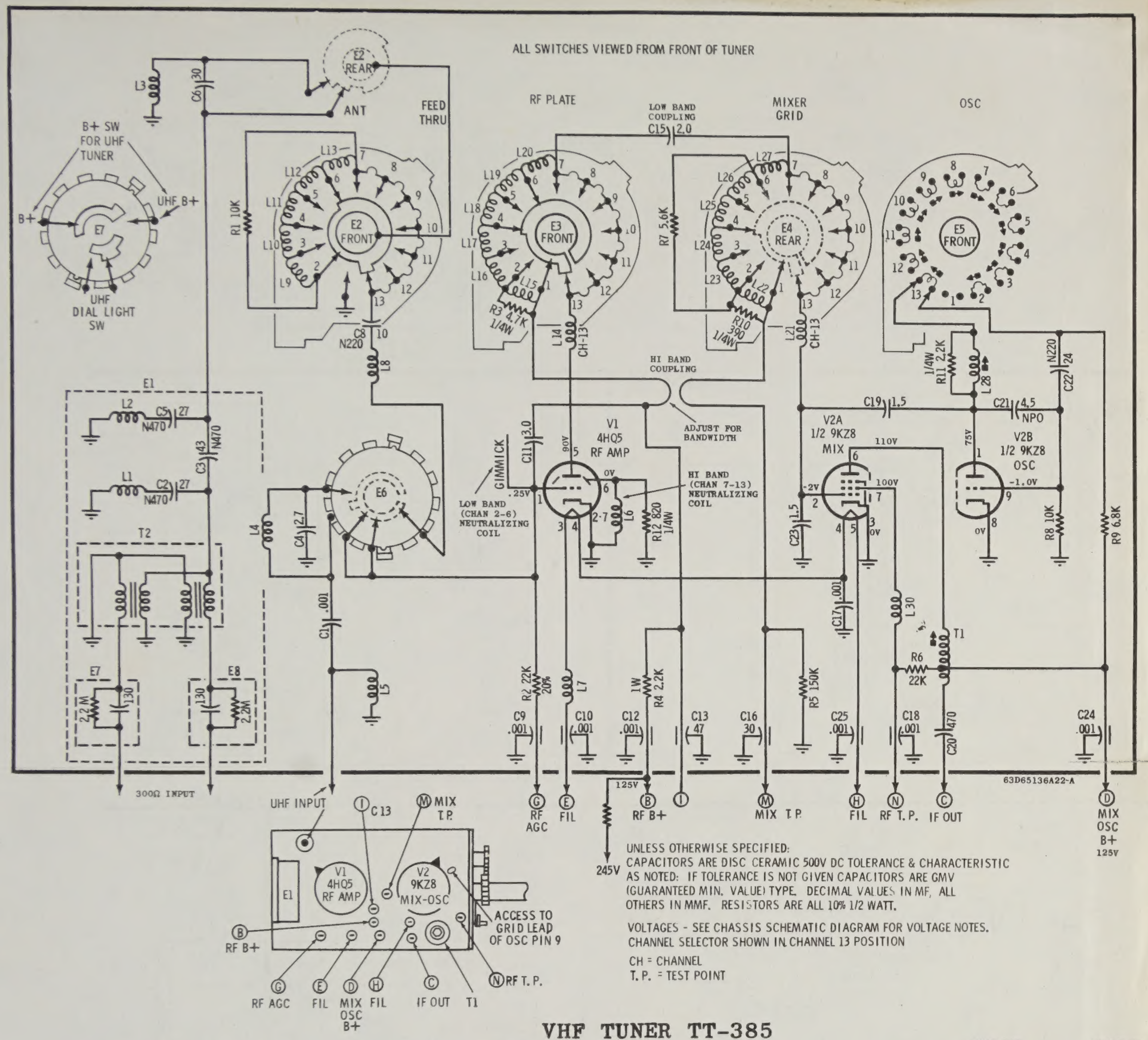
UHF TUNER - KTT-626

Ref. No.	Part Number	Description
C-1	---	TUNING GANG (not replaceable)
C-2	21P65144A76	24 pf feed-thru
C-3	21P65144A77	10 pf
C-4	21P65144A78	470 pf feed-thru
C-5	21P65144A79	100 pf feed-thru
E-1	48P65112A73	DIODE, mixer
L-2	24P65144A74	IF COIL
L-4	24P65144A73	EMITTER COIL
Q-1	48P65144A72	TRANSISTOR (S1019)
	7P65112A74	BRACKET, drive assembly mtg
	47P65144A07	DRIVE SHAFT ASSEMBLY: less mtg brkt
	77D67691A05	UHF TUNER, KTT-626: complete

REVISIONS

Ref. No.	Part Number	Description
E-102	48S191A05	RECTIFIER, silicon: noise gate (replaces 48S191A01)
E-200	48D67120A09	DIODE, horz blanking (replaces 48D67120A02)
E-801		Is a power rectifier not a res-cap
L-112		Should be: L-201 (part number 24D68002A19)
L-508		Should read: L-502 (part number 24C66772A03)

*DENOTES NEW ITEM APPEARING IN ANY LIST FOR FIRST TIME.

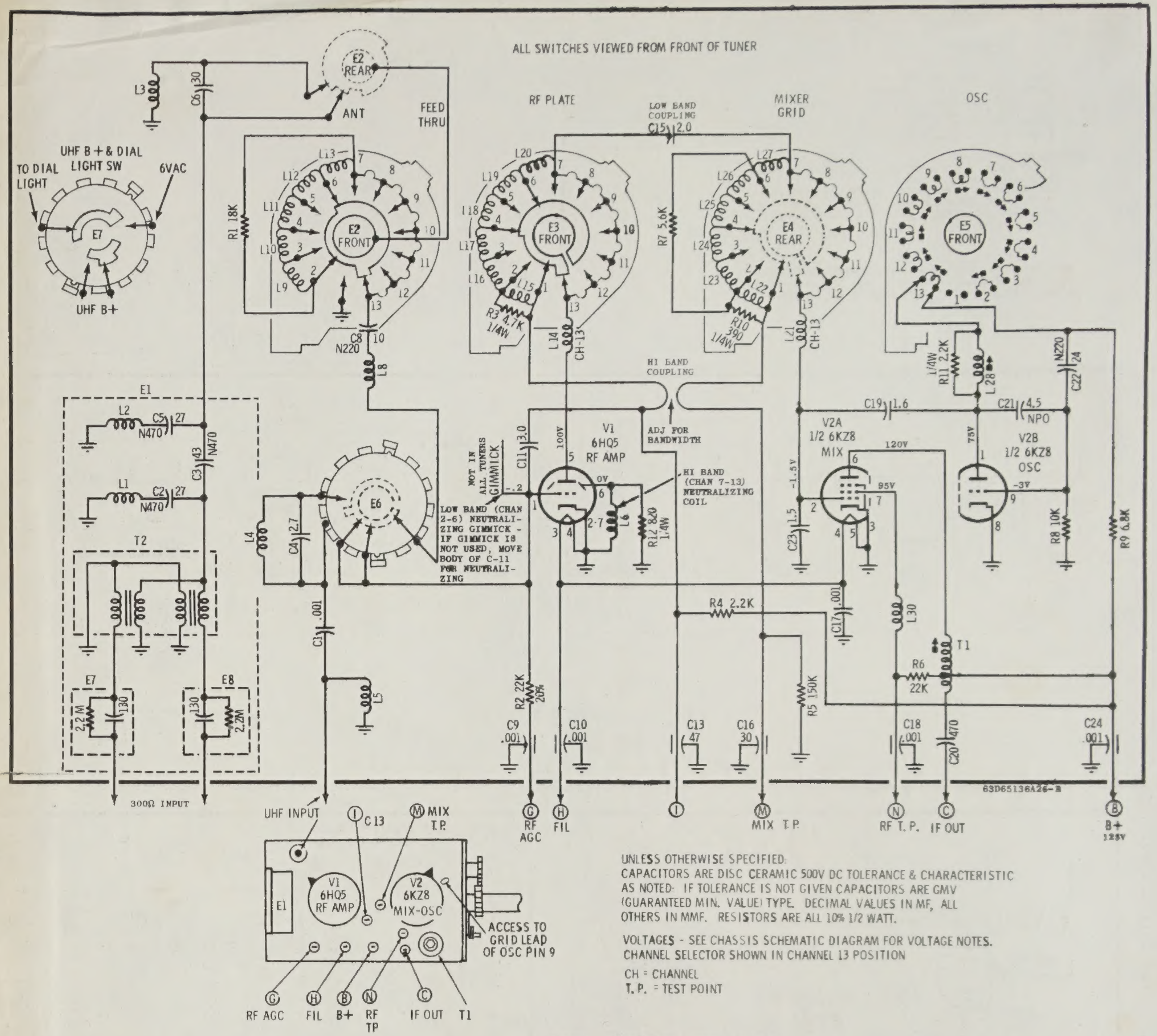

ALL SWITCHES VIEWED FROM FRONT OF TUNER
B+ SW FOR UHF TUNER
E7
UHF B+
UHF DIAL LIGHT SW
L3
C6 30
E2 REAR
ANT
FEED THRU
RF PLATE
LOW BAND COUPLING
C15 2.0
MIXER GRID
OSC
E2 FRONT
E3 FRONT
E4 REAR
E5 FRONT
R1 10K
R7 5.6K
R3 4.7K 1/4W
R10 390 1/4W
C8 N220
L8
L14 CH-13
L21 CH-13
R11 2.2K 1/4W
L28
N220 C22 24
HI BAND COUPLING
ADJUST FOR BANDWIDTH
E1
L2 C5 27 N470
L1 C2 27 N470
C3 43 N470
T2
E6
L4 C4 2.7
C11 3.0
GIMMICK
LOW BAND (CHAN 2-6) NEUTRALIZING COIL
V1 4HQ5 RF AMP
HI BAND (CHAN 7-13) NEUTRALIZING COIL
L6
R12 820 1/4W
C19 1.5
C21 4.5 NPO
V2A 1/2 9KZ8 MIX
V2B 1/2 9KZ8 OSC
C23 1.5
R8 10K
R9 6.8K
C17 .001
L30
T1
R6 22K
C1 .001
L5
E7 2.2M 130
E8 130 2.2M
R2 22K 20%
L7
1W R4 2.2K
R5 150K
C9 .001
C10 .001
C12 .001
C13 47
C16 30
C25 .001
C18 .001
C20 470
C24 .001
300Ω INPUT
63D65136A22-A
UHF INPUT
C13
M MIX T.P.
G RF AGC
E FIL
125V
B RF B+
I
M MIX T.P.
H FIL
N RF T.P.
C IF OUT
D MIX OSC B+ 125V
245V
V1 4HQ5 RF AMP
V2 9KZ8 MIX-OSC
ACCESS TO GRID LEAD OF OSC PIN 9
B RF B+
G RF AGC
E FIL
D MIX OSC B+
H FIL
C IF OUT
N RF T.P.
T1

UNLESS OTHERWISE SPECIFIED:
CAPACITORS ARE DISC CERAMIC 500V DC TOLERANCE & CHARACTERISTIC AS NOTED: IF TOLERANCE IS NOT GIVEN CAPACITORS ARE GMV (GUARANTEED MIN. VALUE) TYPE. DECIMAL VALUES IN MF, ALL OTHERS IN MMF. RESISTORS ARE ALL 10% 1/2 WATT.

VOLTAGES - SEE CHASSIS SCHEMATIC DIAGRAM FOR VOLTAGE NOTES.
CHANNEL SELECTOR SHOWN IN CHANNEL 13 POSITION

CH = CHANNEL
T.P. = TEST POINT

VHF TUNER TT-385

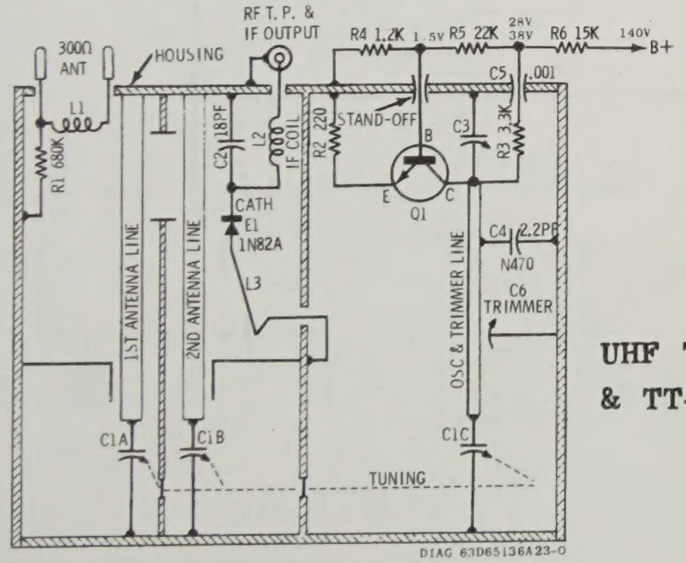

ALL SWITCHES VIEWED FROM FRONT OF TUNER
UHF B+ & DIAL LIGHT SW
TO DIAL LIGHT
6VAC
E7
UHF B+
L3
C6 30
E2 REAR
ANT
FEED THRU
RF PLATE
LOW BAND COUPLING
C15 2.0
MIXER GRID
OSC
E2 FRONT
E3 FRONT
E4 REAR
E5 FRONT
R1 18K
R7 5.6K
R3 4.7K 1/4W
R10 390 1/4W
C8 N220
L8
L14 CH-13
L21 CH-13
R11 2.2K 1/4W
L28
N220 C22 24
HI BAND COUPLING
ADJ FOR BANDWIDTH
E1
L2 C5 27 N470
L1 C2 27 N470
C3 43 N470
T2
E6
L4 C4 2.7
NOT IN ALL TUNERS GIMMICK
C11 3.0
V1 6HQ5 RF AMP
LOW BAND (CHAN 2-6) NEUTRALIZING GIMMICK - IF GIMMICK IS NOT USED, MOVE BODY OF C-11 FOR NEUTRALIZING
HI BAND (CHAN 7-13) NEUTRALIZING COIL
L6
R12 820 1/4W
C19 1.6
C21 4.5 NPO
V2A 1/2 6KZ8 MIX
V2B 1/2 6KZ8 OSC
C23 1.5
R4 2.2K
C17 .001
L30
T1
R6 22K
R8 10K
R9 6.8K
C1 .001
L5
E7 2.2M 130
E8 130 2.2M
R2 22K 20%
R5 150K
C9 .001
C10 .001
C13 47
C16 30
C18 .001
C20 470
C24 .001
300Ω INPUT
63D65136A26-B
G RF AGC
H FIL
I
M MIX T.P.
N RF T.P.
C IF OUT
B B+ 125V
UHF INPUT
C13
M MIX T.P.
V1 6HQ5 RF AMP
V2 6KZ8 MIX-OSC
ACCESS TO GRID LEAD OF OSC PIN 9
G RF AGC
H FIL
B B+
N RF TP
C IF OUT
T1

UNLESS OTHERWISE SPECIFIED:
CAPACITORS ARE DISC CERAMIC 500V DC TOLERANCE & CHARACTERISTIC AS NOTED: IF TOLERANCE IS NOT GIVEN CAPACITORS ARE GMV (GUARANTEED MIN. VALUE) TYPE. DECIMAL VALUES IN MF, ALL OTHERS IN MMF. RESISTORS ARE ALL 10% 1/2 WATT.

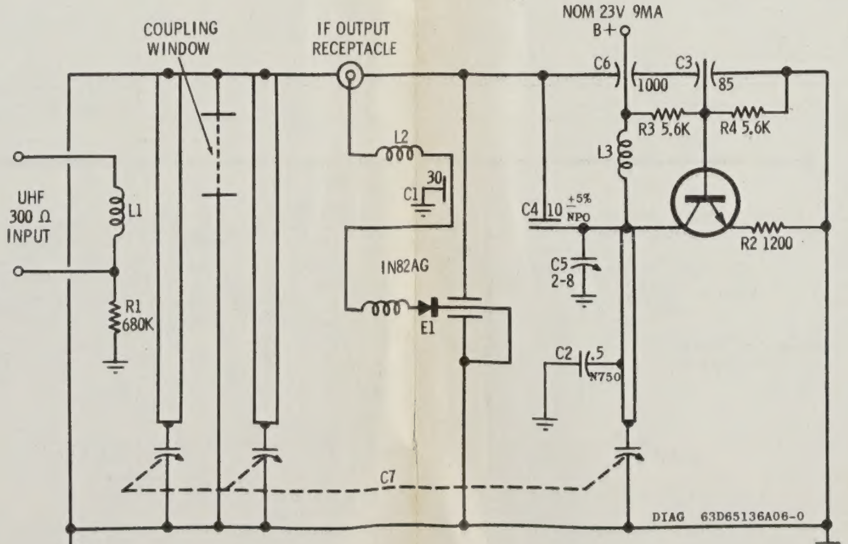
VOLTAGES - SEE CHASSIS SCHEMATIC DIAGRAM FOR VOLTAGE NOTES.
CHANNEL SELECTOR SHOWN IN CHANNEL 13 POSITION

CH = CHANNEL
T.P. = TEST POINT

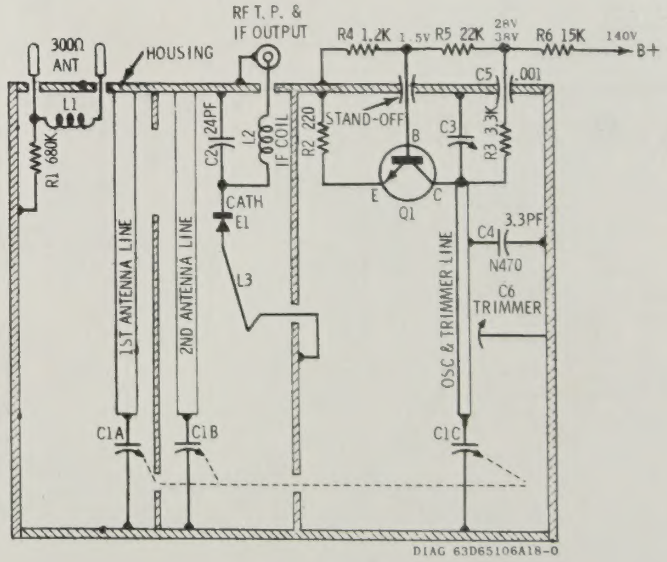
VHF TUNER TT-386


300Ω ANT
HOUSING
RF T.P. & IF OUTPUT
R4 1.2K
1.5V
R5 22K
2.8V 3.8V
R6 15K
140V
B+
L1
R1 680K
C2 18PF
L2 IF COIL
R2 220
STAND-OFF
C5 .001
B
C3
R3 3.3K
E
C
Q1
CATH
E1 1N82A
L3
C4 2.2PF N470
C6 TRIMMER
1ST ANTENNA LINE
2ND ANTENNA LINE
OSC & TRIMMER LINE
C1A
C1B
C1C
TUNING
DIAG 63D65136A23-0

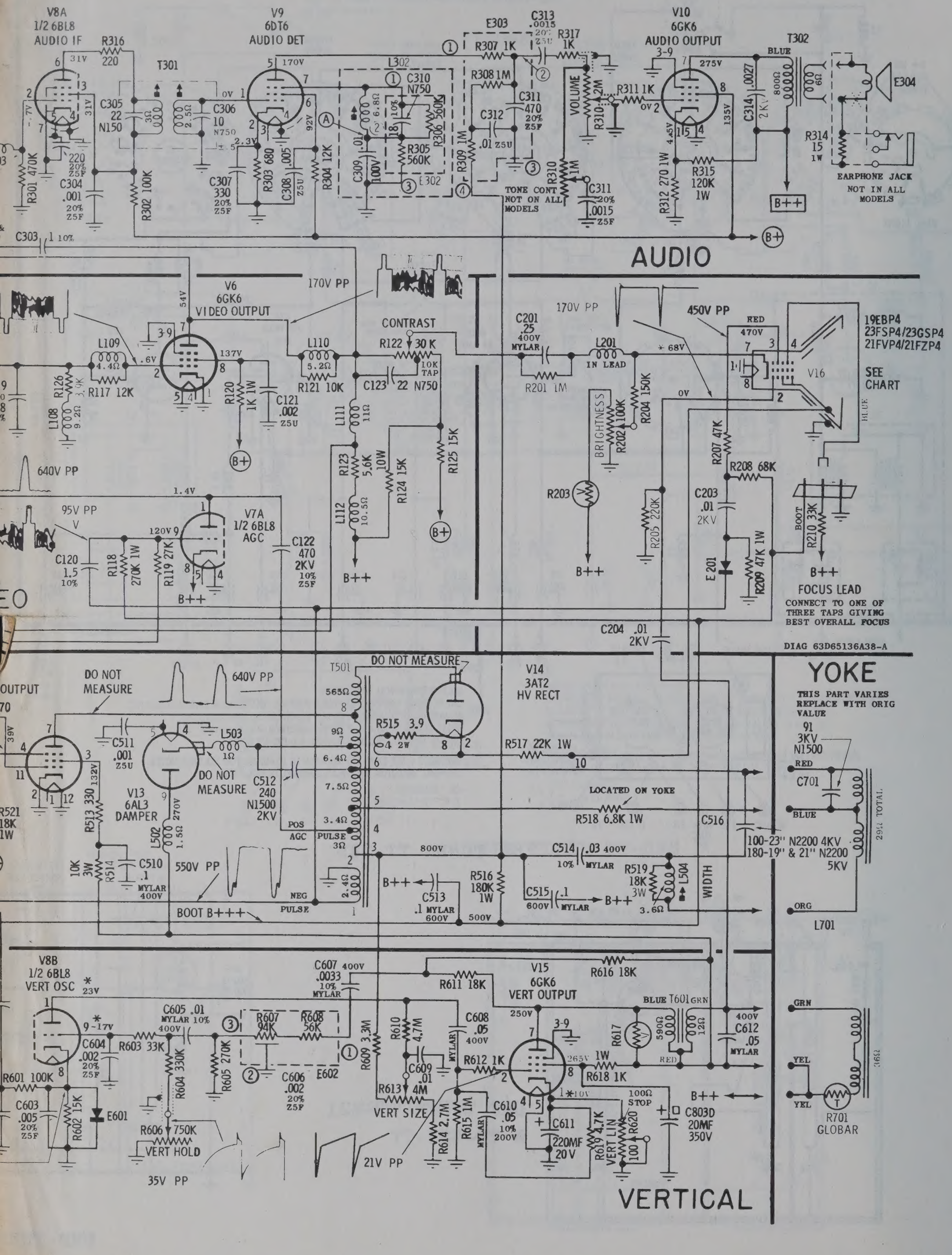
UHF TUNER TT-621 & TT-623


COUPLING WINDOW
IF OUTPUT RECEPTACLE
NOM 23V 9MA
B+
C6 1000
C3 85
R3 5.6K
R4 5.6K
L3
UHF 300 Ω INPUT
L1
L2
C1 30
1N82AG
E1
R1 680K
C4 10 ±5% NPO
C5 2-8
R2 1200
C2 .5 N750
C7
DIAG 63D65136A06-0

UHF TUNER TT-611


300Ω ANT
HOUSING
RF T.P. & IF OUTPUT
R4 1.2K
1.5V
R5 22K
2.8V 3.8V
R6 15K
140V
B+
L1
R1 680K
C2 24PF
L2 IF COIL
R2 220
STAND-OFF
C5 .001
B
C3
R3 3.3K
E
C
Q1
CATH
E1
L3
C4 3.3PF N470
C6 TRIMMER
1ST ANTENNA LINE
2ND ANTENNA LINE
OSC & TRIMMER LINE
C1A
C1B
C1C
DIAG 63D65106A18-0

UHF TUNER TT-622


V8A
1/2 6BL8
AUDIO IF
R316 220
T301
V9
6DT6
AUDIO DET
L302
E303
C313 .0015
R307 1K
R317 1K
R308 1M
V10
6GK6
AUDIO OUTPUT
T302
BLUE
E304
C305 22 N150
C306 10 N750
C304 .001 20% Z5F
R301 470K
R302 100K
C307 330 20% Z5F
R303 680
C308 .005 Z5U
R304 12K
C310 N750
R305 560K
R306 560K
C309 .01 100V
E302
R309 1M
C311 470 20% Z5F
C312 .01 Z5U
VOLUME
R310 2M
R311 1K
TONE CONT NOT ON ALL MODELS
R310 1M
C311 20% .0015 Z5F
C314 .0027 2KV
R314 15 1W
R315 120K 1W
R312 270 1W
EARPHONE JACK NOT IN ALL MODELS
B++
B+
C303 .1 10%
AUDIO
V6
6GK6
VIDEO OUTPUT
170V PP
CONTRAST
R122 30 K
10K TAP
L110 5.2Ω
R121 10K
C123 22 N750
L109 4.4Ω
R126 3.9K
R117 12K
L108 9.2Ω
R120 1K 1W
C121 .002 Z5U
L111 11Ω
R123 5.6K
R125 15K
R124 15K 10W
L112 10.5Ω
640V PP
95V PP
V7A
1/2 6BL8
AGC
C120 1.5 10%
R118 270K 1W
R119 27K
C122 470 2KV 10% Z5F
B++
C201 .25 400V MYLAR
L201 IN LEAD
R201 1M
170V PP
450V PP
R204 150K
BRIGHTNESS
R202 100K
R203
R205 220K
R207 47K
R208 68K
C203 .01 2KV
E201
R209 47K 1W
R210 33K
BOOT
FOCUS LEAD
CONNECT TO ONE OF THREE TAPS GIVING BEST OVERALL FOCUS
19EBP4
23FSP4/23GSP4
21FVP4/21FZP4
V16
SEE CHART
RED 470V
C204 .01 2KV
DIAG 63D65136A38-A
YOKE
THIS PART VARIES REPLACE WITH ORIG VALUE
91 3KV N1500
C701
RED
BLUE
29Ω TOTAL
L701
ORG
DO NOT MEASURE
640V PP
T501
565Ω
V14
3AT2
HV RECT
R515 3.9 2W
R517 22K 1W
C511 .001 Z5U
L503 1Ω
V13
6AL3
DAMPER
C512 240 N1500 2KV
L502 1.5Ω
R513 330
C510 .1 MYLAR 400V
R514 10K 3W
550V PP
BOOT B+++
LOCATED ON YOKE
R518 6.8K 1W
C516
100-23" N2200 4KV
180-19" & 21" N2200 5KV
C514 .03 400V 10% MYLAR
R519 18K 3W
L504
WIDTH
R516 180K 1W
C515 .1 600V MYLAR
C513 .1 MYLAR 600V
800V
500V
POS AGC
PULSE
NEG PULSE
R521 18K 1W
V8B
1/2 6BL8
VERT OSC
C607 .0033 10% MYLAR 400V
R611 18K
R616 18K
V15
6GK6
VERT OUTPUT
T601
C605 .01 MYLAR 10% 400V
R607 94K
R608 56K
E602
C604 .002 20% Z5F
R603 33K
R604 330K
R605 270K
C606 .002 20% Z5F
R601 100K
C603 .005 20% Z5F
R602 15K
E601
R606 750K
VERT HOLD
35V PP
R609 3.3M
R610 4.7M
C608 .05 400V
C609 .01
R613 4M
VERT SIZE
R614 2.7M
R615 1M
21V PP
R612 1K
C610 .05 10% 200V
C611 220MF 20V
R619 4.7K
VERT LIN
R620 100
100Ω STOP
R617
R618 1K
C612 .05 MYLAR
C803D 20MF 350V
GRN
YEL
R701 GLOBAR
VERTICAL

RAM (For complete information, see Service Manual)

SUPPLEMENT NO. 2
TO TS-A914C SERVICE MANUAL,
PART NO. 68P65135A34

television MANUAL 68P65135A36

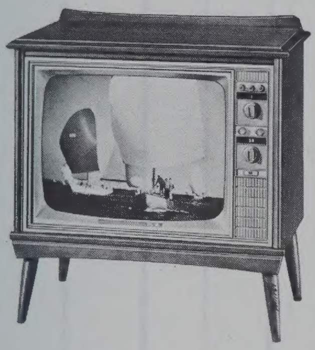
CHASSIS ANTS & AG23TS-A914D & E; E, F, H, J & K23TS-A914D & E

MODELS CT328C, CT329B, RT329B, CT330B, CT331C, LK728C, LK729C, CU787D, CU788D, CL789D, CS790D, CL791D, CL792D, CL793D, CL794D, CL795D, CL796D, CL797D, CL798D

MOTOROLA service manual

SUPPLEMENT NO. 2
TO TS-A914C SERVICE MANUAL,
PART NO. 68P65135A34

television MANUAL 68P65135A36
CHASSIS ANTS & AG23TS-A914D & E;
E, F, H, J & K23TS-A914D & E

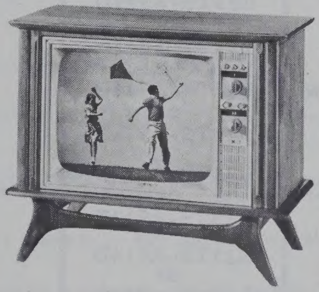

MODEL CU787D

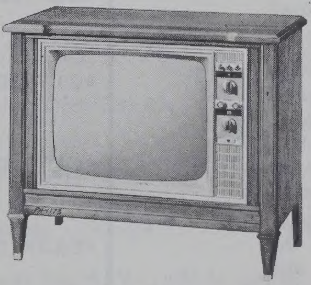
MODEL CU788D

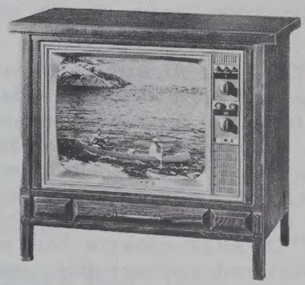
MODEL CL789D

MODEL CS790D

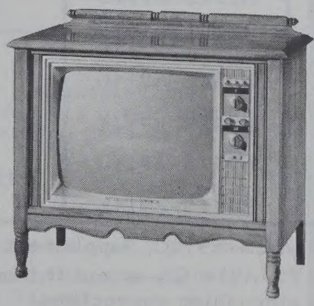
MODEL CL791D


MODEL CL792D


MODEL CL793D


MODEL CL794D

MODEL CL795D


MODEL CL796D

MODEL CL797D

MODEL CL798D

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NOTES:

VOLTAGE MEASUREMENTS

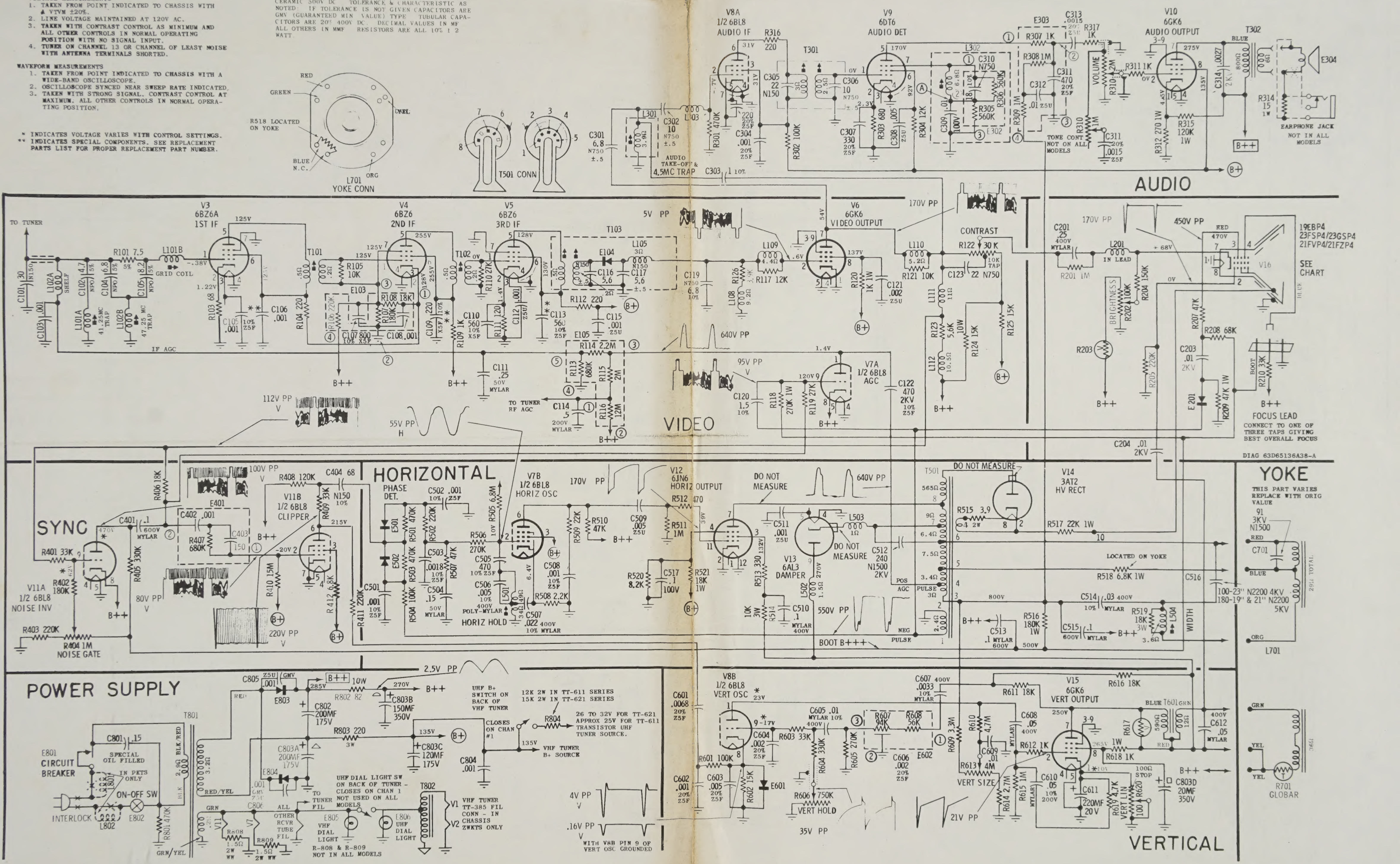
1. TAKEN FROM POINT INDICATED TO CHASSIS WITH A VTVM ±20%.
2. LINE VOLTAGE MAINTAINED AT 120V AC.
3. TAKEN WITH CONTRAST CONTROL AS MINIMUM AND ALL OTHER CONTROLS IN NORMAL OPERATING POSITION WITH NO SIGNAL INPUT.
4. TUNER ON CHANNEL 13 OR CHANNEL OF LEAST NOISE WITH ANTENNA TERMINALS SHORTED.

WAVEFORM MEASUREMENTS

1. TAKEN FROM POINT INDICATED TO CHASSIS WITH A WIDE-BAND OSCILLOSCOPE.
2. OSCILLOSCOPE SYNCED NEAR SWEEP RATE INDICATED.
3. TAKEN WITH STRONG SIGNAL. CONTRAST CONTROL AT MAXIMUM. ALL OTHER CONTROLS IN NORMAL OPERATING POSITION.

* INDICATES VOLTAGE VARIES WITH CONTROL SETTINGS.
** INDICATES SPECIAL COMPONENTS. SEE REPLACEMENT PARTS LIST FOR PROPER REPLACEMENT PART NUMBER.

UNLESS OTHERWISE SPECIFIED CAPACITORS ARE DISC CERAMIC 500V DC TOLERANCE & CHARACTERISTIC AS NOTED: IF TOLERANCE IS NOT GIVEN CAPACITORS ARE GMV (GUARANTEED MIN VALUE) TYPE TUBULAR CAPACITORS ARE 20% 400V DC. DECIMAL VALUES IN MF ALL OTHERS IN MMF RESISTORS ARE ALL 10% 1 2 WATT


RED
GREEN
R518 LOCATED ON YOKE
BLUE N.C.
ORG
L701 YOKE CONN
T501 CONN
V8A 1/2 6BL8 AUDIO IF
V9 6DT6 AUDIO DET
V10 6GK6 AUDIO OUTPUT
T301
T302
E304
L302
E302
E303
VOLUME
TONE CONT NOT ON ALL MODELS
EARPHONE JACK NOT IN ALL MODELS
AUDIO TAKE-OFF & 4.5MC TRAP
AUDIO
TO TUNER
V3 6BZ6A 1ST IF
V4 6BZ6 2ND IF
V5 6BZ6 3RD IF
V6 6GK6 VIDEO OUTPUT
T101
T102
T103
GRID COIL
41.25MC TRAP
47.25 MC TRAP
IF AGC
TO TUNER RF AGC
V7A 1/2 6BL8 AGC
CONTRAST
BRIGHTNESS
V16
19EBP4 23FSP4/23GSP4 21FVP4/21FZP4
SEE CHART
FOCUS LEAD CONNECT TO ONE OF THREE TAPS GIVING BEST OVERALL FOCUS
VIDEO
5V PP
170V PP
450V PP
640V PP
95V PP
112V PP
55V PP H
DIAG 63D65136A38-A
SYNC
V11A 1/2 6BL8 NOISE INV
V11B 1/2 6BL8 CLIPPER
R404 1M NOISE GATE
100V PP
80V PP
220V PP
HORIZONTAL
PHASE DET.
V7B 1/2 6BL8 HORIZ OSC
HORIZ HOLD
V12 6JN6 HORIZ OUTPUT
DO NOT MEASURE
V13 6AL3 DAMPER
V14 3AT2 HV RECT
T501
WIDTH
BOOT B+++
LOCATED ON YOKE
YOKE
THIS PART VARIES REPLACE WITH ORIG VALUE
100-23" N2200 4KV 180-19" & 21" N2200 5KV
L701
POWER SUPPLY
T801
E801 CIRCUIT BREAKER
SPECIAL OIL FILLED
IN PKTS ONLY
ON-OFF SW
INTERLOCK
L802
E802
GRN/YEL
RED/YEL
2.5V PP
UHF B+ SWITCH ON BACK OF VHF TUNER CLOSES ON CHAN #1
12K 2W IN TT-611 SERIES 15K 2W IN TT-621 SERIES
26 TO 32V FOR TT-621 APPROX 25V FOR TT-611 TRANSISTOR UHF TUNER SOURCE.
VHF TUNER B+ SOURCE
UHF DIAL LIGHT SW ON BACK OF TUNER - CLOSES ON CHAN 1 NOT USED ON ALL MODELS
TO TUNER FIL
ALL OTHER RCVR TUBE FIL
VHF DIAL LIGHT
UHF DIAL LIGHT
R-808 & R-809 NOT IN ALL MODELS
T802
VHF TUNER TT-385 FIL CONN - IN CHASSIS ZWKTS ONLY
4V PP
.16V PP
WITH V8B PIN 9 OF VERT OSC GROUNDED
35V PP
21V PP
V8B 1/2 6BL8 VERT OSC
V15 6GK6 VERT OUTPUT
VERT SIZE
VERT HOLD
VERT LIN
T601
R701 GLOBAR
VERTICAL

MOTOROLA TV CHASSIS TS-589C ADVANCE SCHEMATIC DIAGRAM (For complete information, see Service Manual)

SHEET 68P65129A12-B

SUPPLEMENT NO. 2
TO TS-A914C SERVICE MANUAL,
PART NO. 68P65135A34

television **MANUAL 68P65135A36**

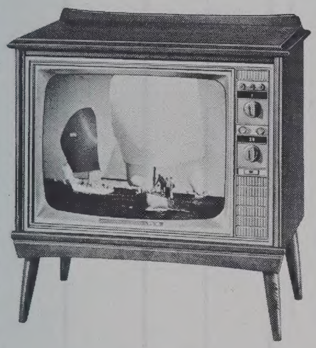
CHASSIS ANTS & AG23TS-A914D & E; E, F, H, J & K23TS-A914D & E

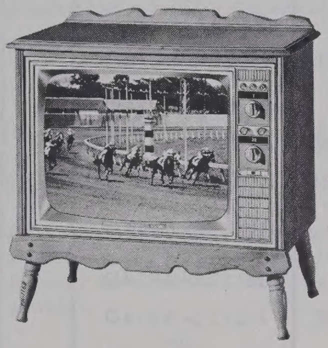
MODELS CT328C, CT329B, RT329B, CT330B, CT331C, LK728C, LK729C, CU787D, CU788D, CL789D, CS790D, CL791D, CL792D, CL793D, CL794D, CL795D, CL796D, CL797D, CL798D

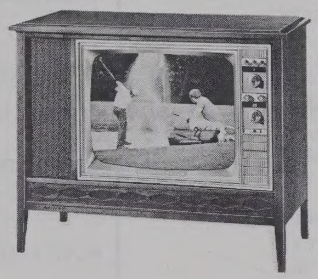
MOTOROLA service manual

SUPPLEMENT NO. 2
TO TS-A914C SERVICE MANUAL,
PART NO. 68P65135A34

television MANUAL 68P65135A36
CHASSIS ANTS & AG23TS-A914D & E;
E, F, H, J & K23TS-A914D & E

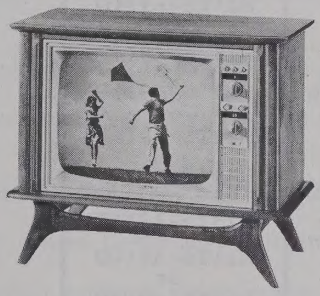

MODEL CU787D

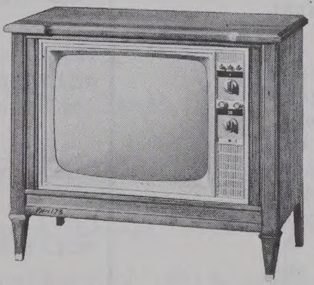

MODEL CU788D

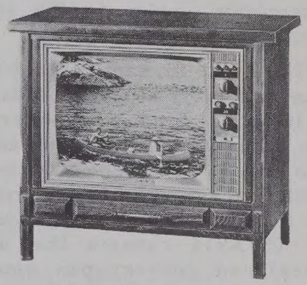

MODEL CL789D

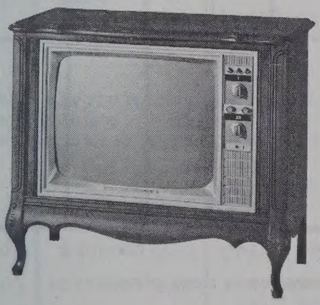
MODEL CS790D

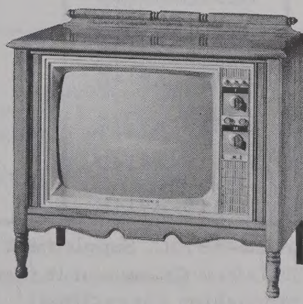
MODEL CL791D

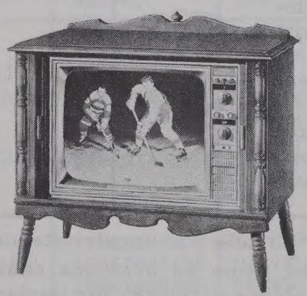

MODEL CL792D

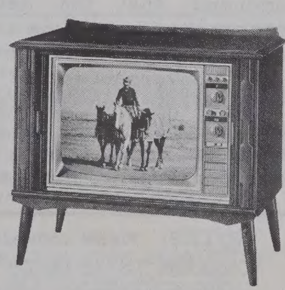

MODEL CL793D


MODEL CL794D


MODEL CL795D


MODEL CL796D


MODEL CL797D


MODEL CL798D

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CHASSIS CODING CHANGES 3
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SPECIAL INFORMATION (SEE "GENERAL INFORMATION") 2
UNIQUE CHASSIS TS-A914D & E REPLACEMENT PARTS LIST 3

GENERAL INFORMATION

This supplement introduces twelve (12) new models previously not listed. It also includes seven (7) models previously introduced in supplement #1. These seven (7) models are identical to those shown in supplement #1 with the exception that a later version of chassis may be used in some of these models. Information unique to these chassis is given in this supplement.

For general service notes, replacement parts list and schematic diagrams of the stereo portion of Models LK728C and LK729C, refer to the TS-A914C, Supplement #1.

This supplement also includes unique information for chassis versions shown herein, as well as the latest chassis schematic diagram, TS-A914D & E. Refer to the "Model Breakdown Chart" for specific information on chassis versions and the "Table Of Contents" for type of information included. For all other information, refer to the original TS-A914C service manual.

NOTE: The dynamic convergence yoke assembly has been redesigned to improve dynamic convergence. The dynamic convergence panel has also been redesigned (component value changes only) to accommodate the new dynamic convergence yoke. All TS-A914 chassis that use the redesigned convergence panel and convergence yoke are coded TS-A914"E" or later and all convergence panels are coded CP-A914"E" or later.

For optimum performance, we recommend that the new convergence yoke assembly is used with chassis coded E-00 and later only. If the new convergence yoke is used with chassis or convergence panels coded earlier than "E", the dynamic convergence range may be limited, making convergence more difficult.

MODEL BREAKDOWN CHART

MODEL	CHASSIS	VHF TUNER	UHF TUNER	CRT
**CT328CN	J23TS-A914D or J23TS-A914E	LOPTT-399	HTT-624 or HTT-627	23EGP22A
**CT329BW	E23TS-A914D or E23TS-A914E			
**RT329BW	ANTS-A914D,E or AG23TS-A914D,E			
**CT330BM,W	E23TS-A914D or E23TS-A914E			
**CT331CW	E23TS-A914D or E23TS-A914E			
**LK728CW	F23TS-A914D or F23TS-A914E			
**LK729CW	F23TS-A914D or F23TS-A914E			
*CU787DM,W	H23TS-A914D or H23TS-A914E			
*CU788DS	H23TS-A914D or H23TS-A914E			
*CL789DM,W	H23TS-A914D or H23TS-A914E			
*CS790DM,W	H23TS-A914D or H23TS-A914E			
*CL791DW	H23TS-A914D or H23TS-A914E			
*CL792DM,W	H23TS-A914D or H23TS-A914E			
*CL793DM	H23TS-A914D or H23TS-A914E			
*CL794DP	H23TS-A914D or H23TS-A914E			
*CL795DF	H23TS-A914D or H23TS-A914E			
*CL796DS	H23TS-A914D or H23TS-A914E			
*CL797DC	H23TS-A914D or H23TS-A914E			
*CL798DW	H23TS-A914D or H23TS-A914E			

NOTES: *New models. **Models previously introduced in TS-A914C, Supplement No. 1.

Chassis TS-A914"D" is the same as previous chassis TS-A914"C" except it incorporates a new pincushion assembly which includes circuitry for horizontal pincushion correction.

Chassis TS-A914"E" is the same as chassis TS-A914"D" except it includes improved dynamic convergence circuitry. See schematic diagram, TS-A914D & E, and "Note" in "General Information" section.

Chassis "H"23TS-A914 incorporates three (3) video drive controls as opposed to two (2) video drive controls used in earlier versions.

Chassis "AG"23TS-A914 is the same as ANTS-A914 except it incorporates three (3) video drive controls.

Chassis "K"23TS-A914 is the same as "J"23TS-A914 except it incorporates three (3) video drive controls.

CHASSIS CODING CHANGES

Chassis Coding	Chassis Coding Changes
TS-A914D-00	DESIGN CHANGE: Horizontal pin cushion correction circuitry added to the pincushion correction assembly (see TS-A914D-00 or later schematic diagram).
TS-A914D-01	RELIABILITY CHANGE: Horizontal output tube 6JS6 screen dropping resistor, R-519 (10K, 10W) changed to 12.5K, 10W.
TS-A914D-00-1 only and E-00 & later	DESIGN CHANGE TO IMPROVE DYNAMIC CONVERGENCE: Dynamic convergence yoke assembly changed to new type. Impedance of vertical coils changed, horizontal coils remain the same. Resistor R-619 (220 ohm) changed to 33 ohm to accommodate above change. Also see convergence panel coding change CP-A914E. For optimum performance, use the new convergence yoke assembly with chassis coded E-00 and later only.
CP-A914-3-1 only and CP-A914E & later	DESIGN CHANGE TO IMPROVE DYNAMIC CONVERGENCE: This change was made to accommodate the new dynamic convergence yoke assembly used in chassis coded TS-A914D-00-1 only and E-00 and later. Blue vertical amplifier control R-712 (60 ohm) was changed to 30 ohms. R-G vertical differential amplifier control R-707 (500 ohm) was changed to 200 ohms. R-704 and R-708 (100 ohm, 2W) replaced with 150 ohm resistor. R-G left side vertical lines control R-705 (60 ohm) changed to 90 ohm. NOTE: The dynamic convergence panel coded CP-A914"E" should be used only with the chassis coded TS-A914E-00 or later, otherwise the dynamic convergence range may be limited. See chassis schematic diagram coded TS-A914"D" & "E" for details.

REVISIONS AND ADDITIONS

REVISIONS AND ADDITIONS TO THE ORIGINAL TS-A914 SERVICE MANUAL.

Page 38	MODEL CL338BF: Change part number of "Cover, cabinet back" (15E67847B04) to read 15E67847B14.
Page 39	Change part number of E-1 (step relay) to read 80D65738A06. Change part number of E-2 (step relay) to read 80D65738A05.

REVISIONS AND ADDITIONS TO TS-A914C, SUPPLEMENT NO. 1.

Page 8 (Figure 3)	In detail, step #1 shows L-905 adjust for minimum. Change L-905 to read L-907. In step #2A, correct sentence which reads: Short pin 8 (V-18B) to ground. Should read - Short pin 2 (V-18B) to ground.

REPLACEMENT PARTS LIST

Unique electrical and mechanical replacement parts for chassis coded TS-A914 "D & E". For all other parts refer to the original TS-A914C Service Manual.

Ref. No.	Part Number	Description
		ELECTRICAL PARTS
L-50	24C66772A01	COIL, RF choke
L-703	*24V68609A47	DYN CONV: incls core & mtg nut (R-G horiz lines)
L-706	24D66800A03	DYN CONV: incls cores: less radial magnet & spring (in C-00 to D-01 except D-00-1)
	*24P65146A78	DYN CONV: incls cores: less radial magnet & spring (in D-00-1 and E-00 & later)
L-707	24D66800A03	DYN CONV: incls cores: less radial magnet & spring (in C-00 to D-01 except D-00-1)
	24P65146A78	DYN CONV: incls cores: less radial magnet & spring (in D-00-1 and E-00 & later)
L-708	24D66800A02	DYN CONV: incls cores: less radial magnet & spring (in C-00 to D-01 except D-00-1)
	24P65146A78	DYN CONV: incls cores: less radial magnet & spring (in D-00-1 & E-00 & later)
	17S135834	12.5K 10% 10W WW
R-138	18D67637A28	DRIVE GREEN: 10K (USE 18D67637A31)
	18D67637A60	GREEN G-1, drive control: 15K (AG, K & G23 & H23TS-A914)
R-139	18D67637A25	DRIVE BLUE: 10K (USE 18D67637A31)
	18D67637A59	BLUE G-1 drive control: 15K (AG, K & G23 & H23TS-A914)
R-140	18D67637A58	RED G-1, drive control: 15K (AG, K & G23 & H23TS-A914)
R-705	18D67671A12	RED-GRN, left side vert lines: 60Ω WW (in C-00 to D-01 except D-00-1)

Ref. No.	Part Number	Description
	*18D67671A14	RED-GRN, left side vert lines: 90Ω, 18Ω stop WW (in D-00-1 and E-00 & later)
R-707	18D67671A05	RED-GRN, vert diff amp: 500Ω WW (in C-00 to D-01 except D-00-1)
	18D67671A07	RED-GRN, vert diff amp: 200Ω WW (in D-00-1 and E-00 & later)
R-712	18D67671A02	BLUE VERT AMP: 60Ω WW (in C-00 to D-01 except D-00-1)
	18D67671A01	BLUE VERT AMP: 30Ω WW (in D-00-1 and E-00 & later)
		MECHANICAL PARTS
	7D67151A03	BRACKET, convergence coil mtg (in C-00 to D-01 except D-00-1)
	*7D67151B04	BRACKET, convergence coil mtg (in D-00-1 and E-00 & later)
	28C67679A02	PLUG, molded: 12-pin: convergence coil assem (in C-00 to D-01 except D-00-1)
	28C67679A03	PLUG, molded: 12-pin: convergence coil assem (in D-00-1 and E-00 & later)
		CABINET PARTS
	16E68099A04	BASE & LEGS ASSEMBLY: mahognay (CS790DM)
	16E68099A05	BASE & LEGS ASSEMBLY: walnut (CS790DW)
	*13P65146A77	BEZEL, CRT: incls; nameplate, overlays, doors & windows (CU787DM,DW, 788DS; CL789DW,DM, 791DW, 792DW, 793DM, 794DP, 795DF, 796DS, 797DC, 798DW; CS790DW,DM)
	13P65143A42	BEZEL, CRT: incls; nameplate, overlays, doors & windows (CU787DW-1, CL789DW-1, CL792DW-1, CL794DP-1)
	13P65143A54	BEZEL, CRT: incls; nameplate, overlays, doors & windows (CU788DS-1, CL796DS-1)
	75B67953A01	BUMPER, plastic: cabinet foot (CU788DS, CL789DM & DW, CS790DM & DW)
	16E68055A01	CABINET, console: mah (CL789DM)
	16E68055A02	CABINET, console: walnut (CL789DW)
	16E68119A01	CABINET, console: walnut (CL791DW)
	16E68094A01	CABINET, console: walnut (CL792DW)
	16E68095A01	CABINET, console: mah (CL793DM)
	16E68232A01	CABINET, console: pecan (CL794DP)
	16E68090A01	CABINET, console: fruitwood (CL795DF)
	16E68097A01	CABINET, console: maple (CL796DS)
	16E67915A02	CABINET, console: cherrywood (CL797DC)
	16E67915A11	CABINET, console: walnut (CL798DW)
	16E68099A01	CABINET, console: mah (CS790DM)
	16E68099A02	CABINET, console: walnut (CS790DW)
	16P65143A22	CABINET, console: mah (CU787DM)
	16P65143A23	CABINET, console: walnut (CU787DW)
	16P65143A17	CABINET, console: maple (CU788DS)
	42C66732A02	CLIP, terminal: VHF-UHF ant term
	30B738152	CORD, line (USE 30K741023)
	15F67847A13	COVER, cabinet back: masonite (CL789DM, DW)
	15F67847A15	COVER, cabinet back: masonite (CL791DW, CL792DW)
	15F67847A14	COVER, cabinet back: masonite (CL793DM, CL795DF, CL796DS)
	15F67847A20	COVER, cabinet back: masonite (CL794DP)
	15F67847A17	COVER, cabinet back: masonite (CL797DC, CL798DW)
	15F67847A16	COVER, cabinet back: masonite (CS790DM, DW)
	15E67847A19	COVER, cabinet back: masonite (CU787DM, DW, CU788DS)
	15D68244A02	COVER, CRT rear: cabinet back
	*34D68038A04	DIAL, scale: UHF
	34D68038A03	DIAL, scale: UHF (CU787DM, DW & CU788DS only)
	*34D68038A05	DIAL, scale: VHF
	34D68038A01	DIAL, scale: VHF (CU787DM, DW & CU788DS only)
	*15D68028A05	DOOR, control: gold
	15D68028A03	DOOR, control: charcoal brown
	55C63659A40	DOOR, pull (CL794DP)
	16E67915A07	DOOR, tambour: left (CL797DC)
	16E67915A12	DOOR, tambour: left (CL798DW)
	16E67915A08	DOOR, tambour: right (CL797DC)
	16E67915A13	DOOR, tambour: right (CL798DW)
	16E68097A02	GALLERY, rail (CL796DS)
	16E67915A09	GALLERY, rail (CL797DC)
	16E67915A14	GALLERY, rail (CL798DW)
	*16E68183A13	GALLERY, rail (CU787DW)
	16E68182A04	GALLERY, rail (CU788DS)
	*35D67457A80	GRILLE CLOTH: (CL789DM)
	35D67457A79	GRILLE CLOTH: (CL789DW)
	55C67418A01	HINGE, control door (LH)
	55C67418A02	HINGE, control door (RH)
	72D67866A05	INDICATOR, color light (gold background)
	72D67866A04	INDICATOR, color light (char brn background)
	36D68047A01	KNOB, control: hue, intensity & tint
	*36D68171A06	KNOB, fine tune (insert char. brn)
	*36D68171A02	KNOB, fine tune (insert gold)
	36D68171A05	KNOB, on-off-volume (insert char brn)
	36D68171A01	KNOB, on-off-volume (insert gold)
	36D67738A03	KNOB, tuner: UHF
	36D67738A01	KNOB, tuner: VHF
	16E67915A10	LEG, cabinet (CL797DC)
	16E67915A15	LEG, cabinet (CL798DW)
	16B68087A02	LEG, cabinet (CU787DM)
	16B68087A03	LEG, cabinet (CU787DW)
	16B68092A01	LEG, cabinet (CU788DS)
	33C68104A07	NAMEPLATE, bezel (char brn with gold lettering)
	33C68104A01	NAMEPLATE, bezel (gold with black lettering)
	13B68034A02	OVERLAY, control panel (finish char brn)
	13B68034C01	OVERLAY, control panel (finish gold)
	64A67158A02	PLATE, leg mtg (CU787DM, DW, CU788DS, CL797DC, CL798DW)
	50D66232A11	SPEAKER, 4": PM
	50D67952A02	SPEAKER, 6": PM (CL789DM, DW)
	41A66675A05	SPRING, control door
	16E68183A09	STRETCHER, front (CU787DM)
	16E68183A14	STRETCHER, front (CU787DW)
	16E68182A05	STRETCHER, front (CU788DS)
	61D68033A01	WINDOW, channel number

*DENOTES NEW ITEM APPEARING IN ANY LIST FOR FIRST TIME.

MOTOROLA TS-594 CHASSIS – IN-CIRCUIT TRANSISTOR TESTING

The technique of increasing forward bias to turn on a transistor and noting corresponding voltage changes was applied to a TS-594 chassis and the following chart shows the voltage changes as extra forward bias was applied. These voltages should not be related specifically to a set being analyzed but rather to the extent of the voltage change on the various transistor elements.

The no signal voltages were taken with the channel selector tuned between channels. It appears that the easiest fastest method of using this technique is to monitor the collector voltage under no signal conditions and then note the change in collector voltage when forward bias is increased. This technique applies for all stages while monitoring emitter voltage is not applicable in stages where the emitter is grounded (sync clipper, 4.5Mc amplifier).

TRANSISTOR	RESISTOR BRIDGED	VALUE RES USED		NO SIGNAL		WITH SIGNAL	
				NORM	BRIDGED	NORM	BRIDGED
Q-1 1ST IF	R106(33K)	33K	E	1.3V	2.8V	3.25V	3.4V
			B	1.9V	3.5V	4V	4.2V
			C	25.5V	14V	12V	10.5V
Q-2 2ND IF	R106(33K)	33K	E	1.3V	2.8V	3.2V	3.3V
			B	1.9V	3.55V	3.9V	4.1V
			C	25V	14V	12V	10.5V
Q-3 3RD IF	R111(6.8K)	6.8K	E	1.35V	2V	1.35V	1.9V
			B	1.9V	2.7V	1.9V	2.6V
			C	10V	2.2V	10V	2.3V
Q-4 1ST VIDEO AMP	R804(27K)	27K	E	2.7V	3.9V	1.6V	2.3V
			B	3.3V	4.5V	2.2V	2.9V
			C	13V	4.1V	20V	15V
Q-5 2ND VIDEO AMP	R804(27K)	27K	E	2.4V	3.1V	1.4V	1.9V
			B	2.7V	3.7V	1.6V	2.3V
			C	40V	6V	90V	60V
Q-6 4.5MC AMP	R300(82K)	82K	E	0	0	0	0
			B	.6V	.6V	.4V	.4V
			C	3.2V	1.8V	2.5V	1.4V
Q-7 AUDIO DRIVER	R306(2.2M)	1.5M	E	.05V	.07V	.05V	.07V
			B	.5V	.55V	.5V	.55V
			C	160V	60V	160V	60V

The remaining stages may not be turned on when the forward bias source resistance is bridged with an equivalent value resistance because the stage is not biased Class A. The resistance must then be bridged with a lower value resistance to provide sufficient forward bias to turn the stage on.

TRANSISTOR	RESISTOR BRIDGED	VALUE RES USED		NO SIGNAL		WITH SIGNAL	
				NORM	BRIDGED	NORM	BRIDGED
Q-8 AGC GATE	R402(220K)	100K	E	*35V	33.5V	34.5V	33.5V
			B	25V	34V	31V	34V
			C	67V	34V	42V	34V
Q-9 AGC AMP (PNP)	R402(220K)	100K	E	35V	32.5V	33.5V	32.5V
			B	35V	32V	33V	31.5V
			C	2.2V	22V	11V	22V
Q-10 NOISE GATE	R403(47K)	22K	E	3.3V	4V	2.6V	2.5V
			B	1.1V	4.6V	1.1V	3.2V
			C	27V	0V	29V	3V
Q-11 SYNC SEP	R414(1.2M)	100K	E	0	0	0	0
			B	.5V	.55V	-1.5V	+.3V
			C	5.5V	.1V	110V	40V

*The emitter of the AGC gate transistor is connected to the regulated +33V supply. The 33 volt supply is regulated with a 33 volt ± 10% Zener diode so the allowable range of voltages on the buss is 30 to 36 volts. In the particular set involved in these measurements, the Zener regulated at 35 volts so voltages on the 33 volt buss will read 35 volts normally and there is no transistor phenonmeon causing a 2 volt rise in the voltages shown as 33 volts on the schematic.

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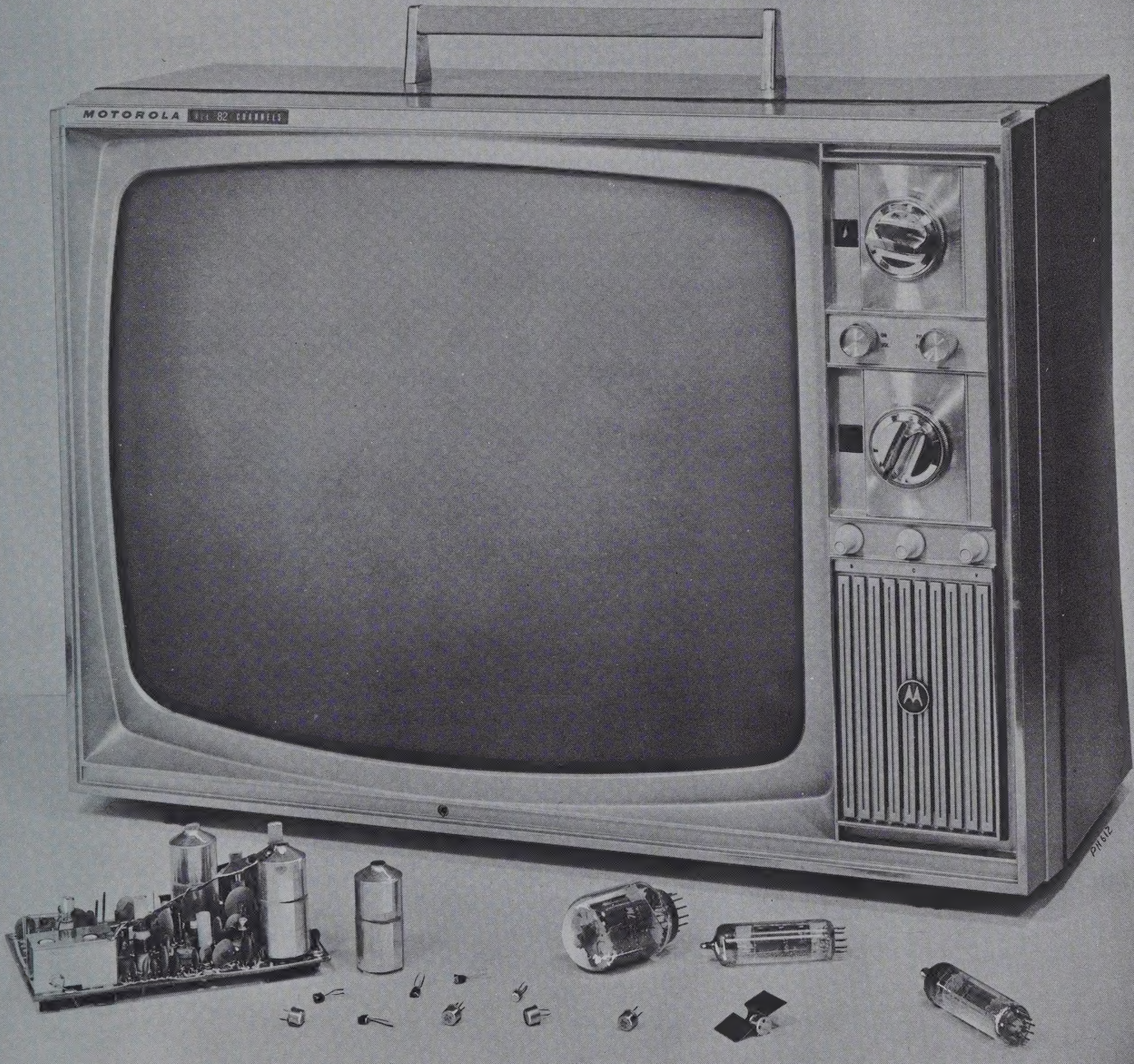
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MOTOROLA TRANSISTOR TV

The TS594 chassis introduces transistors to large screen black and white television with:

1. No sacrifice of performance. High voltage, brightness, sensitivity, noise figure, video response, etc., will be comparable to the TS-589 chassis.

2. Improved reliability. Experience has proven that the proper application of transistors to replace their tube counterparts has resulted in improved reliability. Proper application of transistors includes running the transistors well within voltage, current and temperature ratings as well as careful design attention toward minimum use of low voltage high capacity electrolytics. Since the engineering background for the TS594 chassis draws upon a wealth of experience with transistor application in consumer products as well as the latest technological developments from the laboratories of one of the world's foremost manufacturers of transistors, you may rest assured that the transistor applications represent usage with all pertinent factors carefully evaluated.

3. Transistor and Tube (Hybrid) Chassis. While today's transistors and other solid state devices can replace every tube function (except CRT) in a television chassis, in some specific applications the transistor can incur some penalities. Two examples of these transistor applications are: RF transistors as used in the TV tuner and high voltage transistors as used in the horizontal output system. While the RF transistor maintains improved reliability, its performance characteristics with respect to overload, cross modulation and automatic gain control pose additional problems (and cost). In the case of the horizontal output transistor, the voltage breakdown characteristics versus cost can result in a circuit design that is marginal with respect to reliability and performance.

After careful evaluation of all factors, Motorola engineers have developed a chassis that affords the best possible combination of transistors and tubes which does not incur a major cost premium for transistors and yet results in a high performance highly reliable receiver.

There are two other important factors to be cognizant of with respect to transistorized TV. One is the operation requirements of the receiver. If, for example, battery operation is contemplated, the RF transistor characteristics can be handled with signal attenuating pads and the horizontal output system characteristics can be handled by selecting a smaller size CRT which will reduce the system requirements. Note, however, battery operation is not a TS594 chassis requirement and that a large size CRT is a chassis requirement.

The second factor is that the state of the art involving transistors is developing so rapidly you can expect to very shortly see transistors developed for these applications that will be equal to or superior to tubes.

GENERAL DESCRIPTION - TS-594 CHASSIS

The TS-594 chassis utilizes 12 silicon transistors, 8 vacuum tubes, 12 diodes, 1 Zener diode and a conventional high drive picture tube as shown in Figure #1.

The transistors for the most part are used in low voltage, low power applications. Tubes are used in the high voltage, high power applications such as horizontal and vertical output systems. The VHF tuner is the tried and proven tube type as used in the TS-589 chassis.

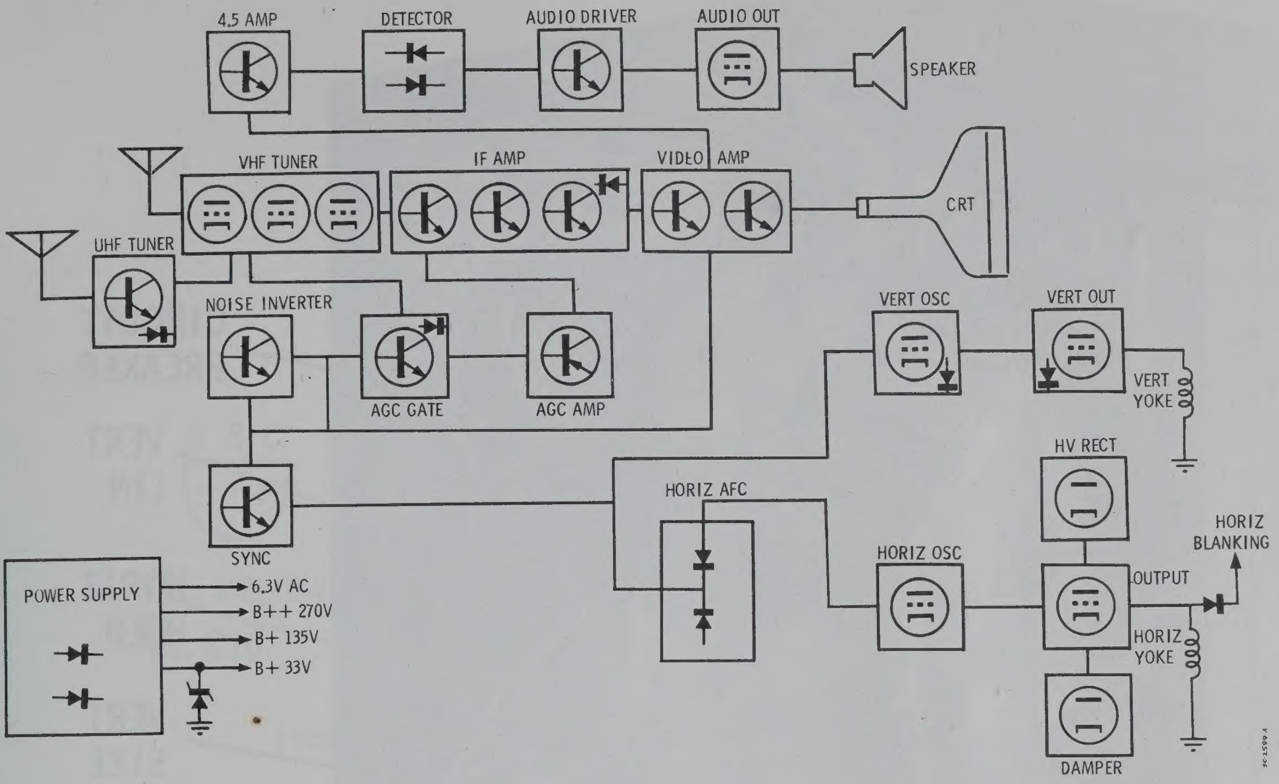

4.5 AMP
DETECTOR
AUDIO DRIVER
AUDIO OUT
SPEAKER
VHF TUNER
IF AMP
VIDEO AMP
CRT
UHF TUNER
NOISE INVERTER
AGC GATE
AGC AMP
VERT OSC
VERT OUT
VERT YOKE
HV RECT
SYNC
HORIZ AFC
HORIZ OSC
HORIZ BLANKING
OUTPUT
HORIZ YOKE
DAMPER
POWER SUPPLY
6.3V AC
B++ 270V
B+ 135V
B+ 33V

FIGURE 1 - BLOCK DIAGRAM OF TS-594

The transistors and their circuitry are all contained on an etched panel measuring 4-1/2 x 6 inches. This panel is located in the center of a conventional hand-wired chassis. The circuit board is etched on the bottom side only and has a legend on the top and bottom to identify circuitry and components.

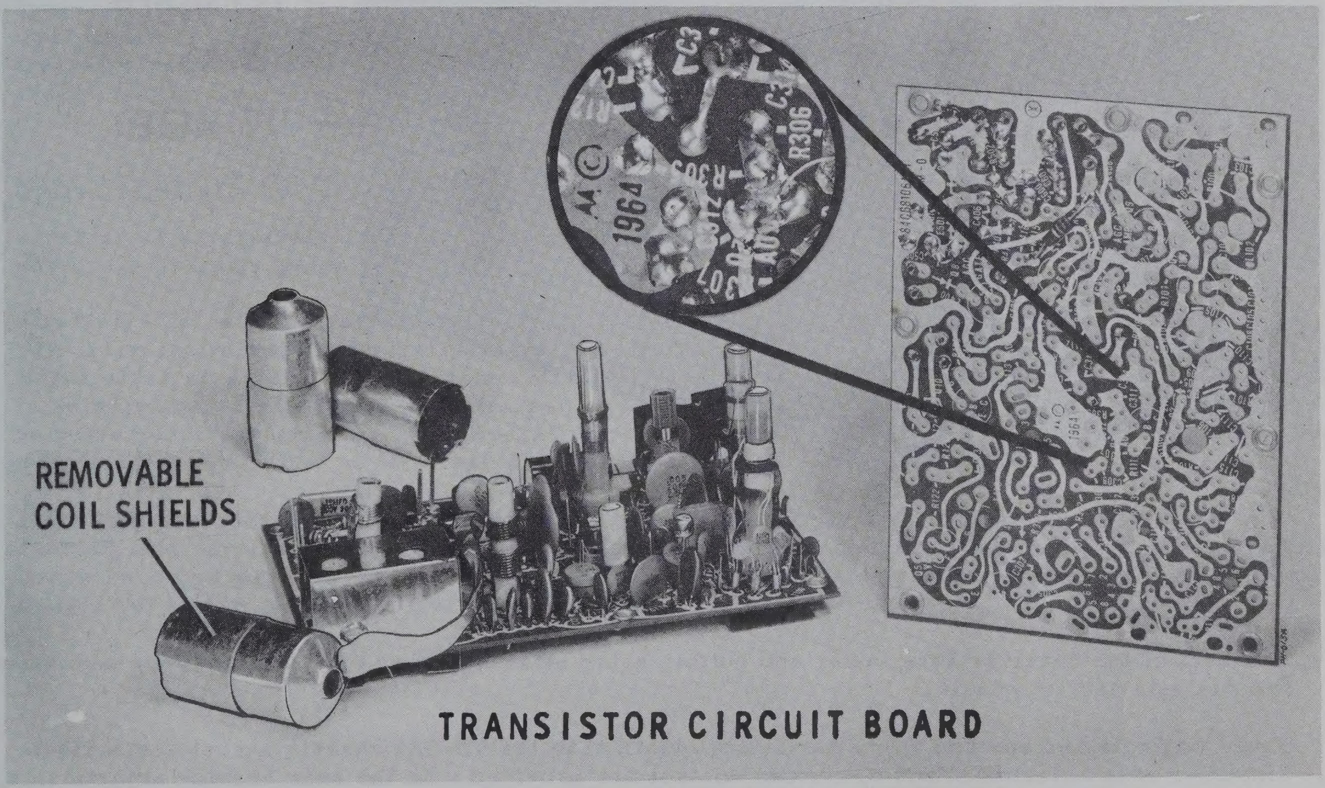

REMOVABLE COIL SHIELDS
TRANSISTOR CIRCUIT BOARD
R306
1964

FIGURE 2

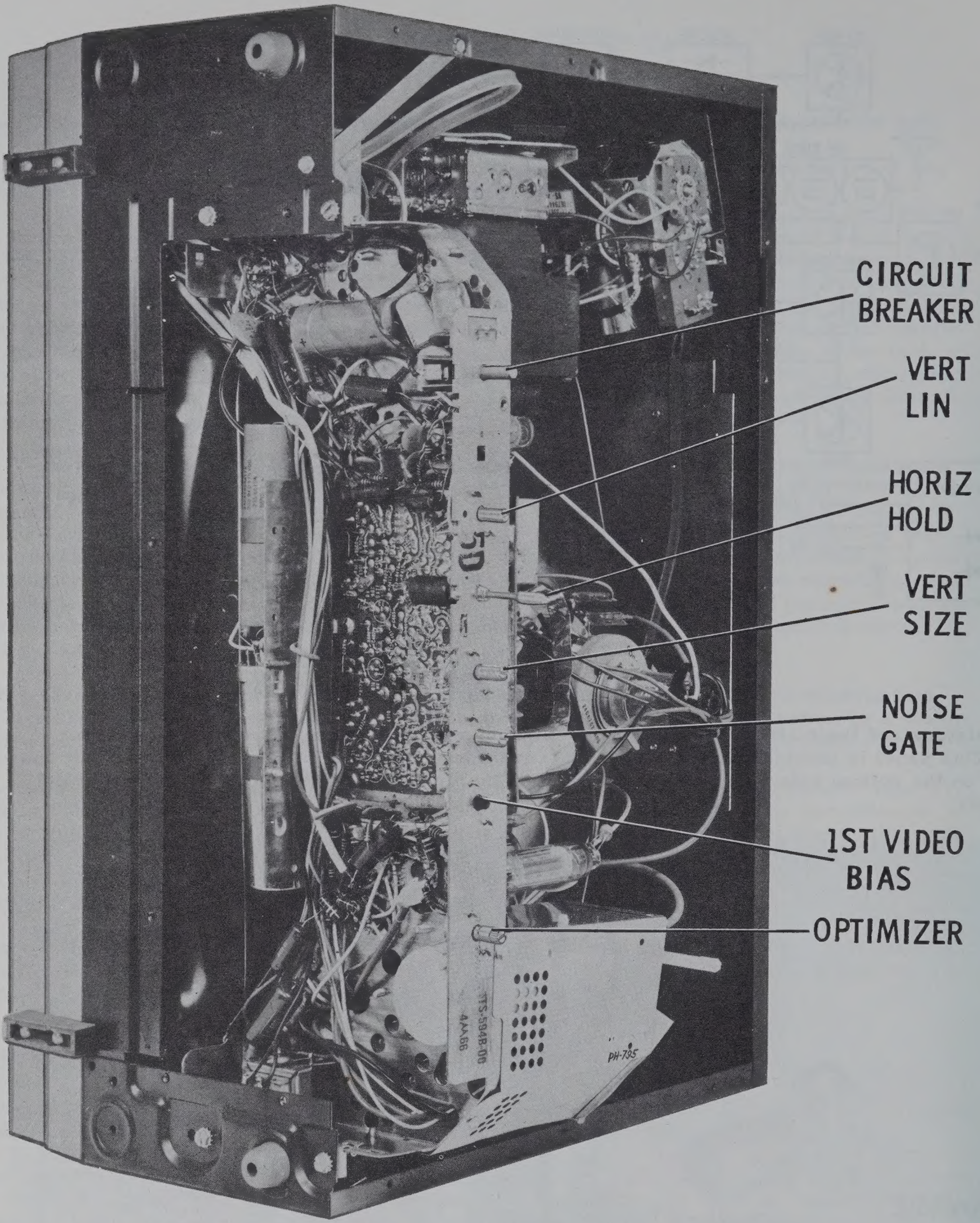

CIRCUIT BREAKER
VERT LIN
HORIZ HOLD
VERT SIZE
NOISE GATE
1ST VIDEO BIAS
OPTIMIZER
PH-795

FIGURE 3

Removal of the receiver back cover and bottom panel affords access to virtually every component for analysis and/or removal.

Front controls and service adjustments are identical to the TS-589 chassis except that a video amplifier bias adjustment and optimizer control are provided with the rear service adjustments.

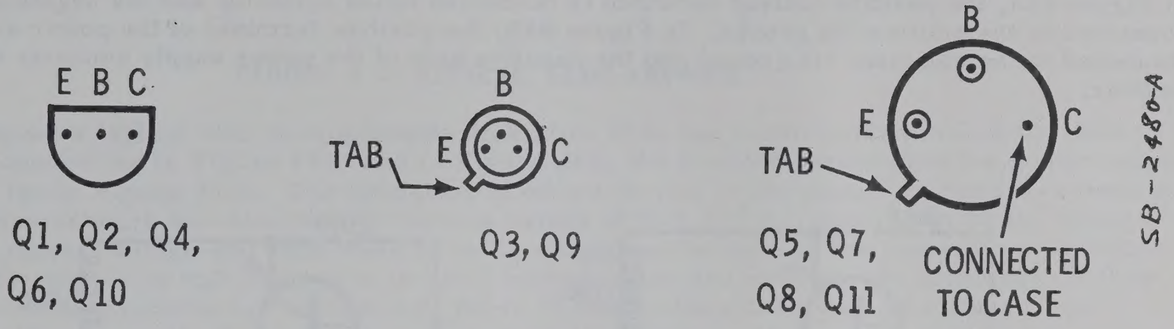


FIGURE 4 - TRANSISTOR BASE DIAGRAMS (BOTTOM VIEW)

TRANSISTOR BASING

Although it would be desirable to standardize the arrangement of transistor leads so every transistor has the same configuration, it has become necessary on some new types of transistors to position the leads as a function of internal construction or the circuit application (particularly in high frequency circuits). Therefore, it is a good practice to ascertain the various lead connections on each transistor during circuit analysis. This is simplified by the legend on the bottom of the panel and replacement transistors can be compared to the diagram on the schematic. Figure #4 shows the transistor base diagrams for the TS-594 transistors.

BASIC TRANSISTOR OPERATION

A review of transistor operation and biasing will aid in understanding the circuit description and service techniques which will follow.

The NPN silicon transistor used in the TS-594 chassis differs in two important aspects from the PNP germanium transistor that has been so common. First, the forward bias (turn on) voltage is in the order of .6V for a silicon transistor as compared to .2V for the germanium transistor. This is an important service consideration because while .2V forward bias can indicate normal operation on a germanium transistor, the same .2V forward bias on a silicon transistor can be indicative of a stage that is oscillating or is turned off because of insufficient forward bias.

Since this basic forward bias difference exists between silicon and germanium transistors in general, and since more and more silicon transistors are finding their way into consumer products, it now becomes a good service practice to first determine the type of transistor involved by consulting the schematic and/or noting the specified base emitter bias.

Second, the polarity of the voltages applied to the three elements is reversed on an NPN transistor as compared to a PNP transistor. Two methods of connecting the correct voltage polarity to an NPN transistor are shown in Figure #5.

An easy way to remember the voltage polarity that should be connected to a transistor is: the polarity of the power supply that is connected to the emitter should correspond to the type of material in the emitter. With an NPN transistor, the emitter is N material and should have the negative side of the supply connected to it. On a PNP transistor, the emitter is P material and the positive side of the supply should be connected to the emitter.

Once correct polarity for the emitter is established, it is a simple matter to connect the other side of the power supply to the collector.

In Figure #5A, the positive battery terminal is connected to the collector and the negative side is connected to the emitter via ground. In Figure #5B, the positive terminal of the power supply is connected to the collector via ground and the negative side of the power supply connects to the emitter.

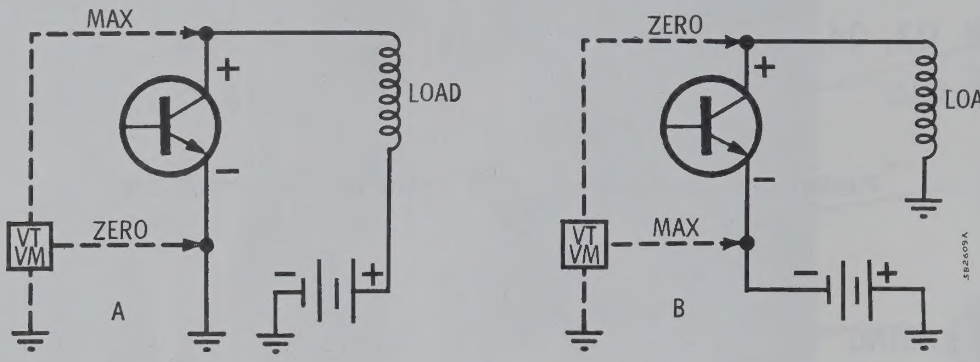


FIGURE 5A & B - BATTERY CONNECTS TO NPN TRANSISTORS

The operation of either stage is identical. Note that the same voltage of the same polarity appears across each transistor. In either case, the negative side of the power supply is connected to the emitter as has been established for a NPN transistor.

The only difference between Figure A and B is the voltage on the transistor elements as measured to ground and since the service technique is to measure voltages as referenced to ground, this becomes an important service consideration. In Figure #5A, the collector voltage is near maximum or supply voltage and the emitter voltage is zero while in Figure #5B, the collector voltage is near zero and the emitter voltage is near maximum (negative) or supply voltage. The important consideration is the voltage across the transistor elements and in both cases, the collector is equally positive with respect to the emitter.

Another consideration is the polarity and magnitude of voltage that must be applied to the base/emitter elements in order to turn the transistor on and cause electrons to flow from emitter to collector. While a tube requires bias to reduce electron flow, the transistor requires bias to cause electrons to flow. A tube with zero bias between grid and cathode will generally have heavy current flow while a transistor with zero bias between base and emitter is turned off and no current will flow.

To forward bias or turn on a transistor, a small voltage is applied between the base and emitter elements. When measured from the emitter, the polarity of this bias voltage will be the same as the collector voltage.

A good rule to remember is that as the voltage on the base element is changed in the direction of the collector potential, the emitter/collector current will increase. If the voltage on the base element is changed in the direction of the emitter potential, the emitter/collector current will decrease. This is true regardless of whether the transistor is silicon or germanium and NPN or PNP.

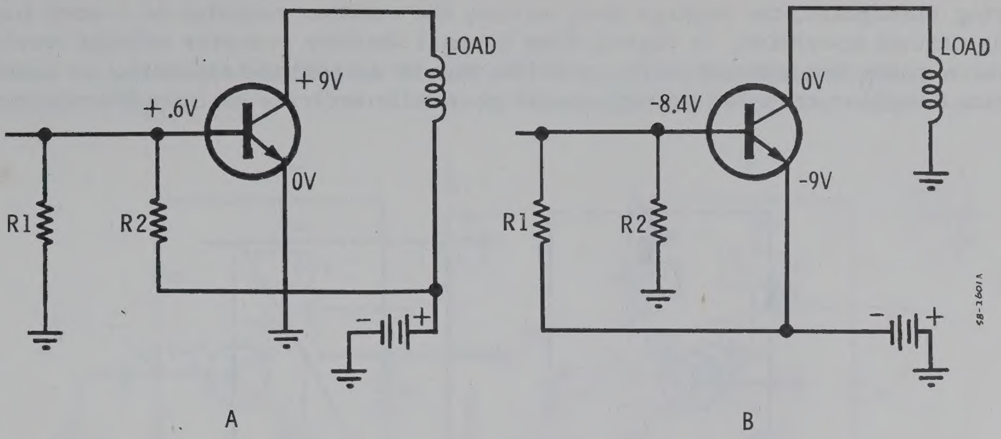


FIGURE 6 - TYPICAL BIAS NETWORK

Figure #6 shows a typical bias arrangement. In Figure #6A, the negative terminal of the power supply is grounded (as in Figure #5A) and in Figure #6B, the positive terminal of the power supply is grounded (as in Figure #5B). The operation of either circuit is identical. R-2 and R-1 form a voltage divider network and selection of various values of R-2 and R-1 can result in any voltage between the supply voltage and zero volts to be developed on the base of the transistor. If values are chosen to cause a .6 volt difference to exist between base and emitter, the transistor will be turned on and emitter/collector current will flow. If this voltage difference is reduced, less collector/emitter current will flow and conversely if this voltage difference is increased, more collector/emitter current will flow.

In Figure #6A, if a 9 volt supply is used, R-2 would be approximately 8.5 times as large as R-1 and +.6 volt would be developed on the base. In Figure #6B, the values of R-1 and R-2 stay the same except their relative positions are reversed to affect a -8.4 volt potential on the base. In either case, the base is +.6 volt with respect to the emitter.

The voltages shown are typical for a silicon transistor. Note that the base voltage is close to the emitter voltage and between the collector/emitter voltage. The collector/emitter voltage can vary considerably in various applications, but the base voltage will be close to the emitter voltage and generally .6 volt away from the emitter voltage toward the collector voltage.

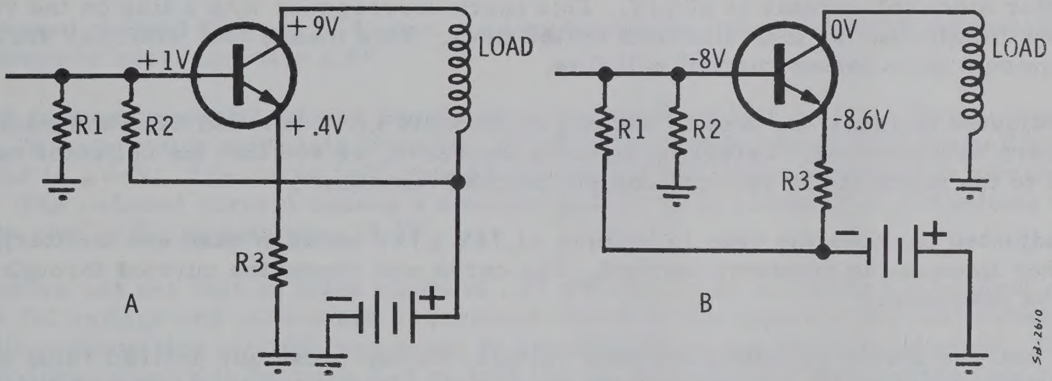


FIGURE 7 - EMITTER RESISTOR ADDED

In Figure #7, a third resistor, R-3, has been added in series with the emitter. This resistor is used to stabilize the collector current and is often referred to as a current limiter or stabilizing resistor. As collector current flows through the emitter resistor (R-3), a voltage is developed which opposes the forward bias voltage. The effect of R-3 is to oppose any change in current flow since the voltage across it is in series with the foward bias voltage. For example, if collector current increases, the voltage drop across R-3 increases and reduces the effective forward bias which, in turn, reduces collector current. Conversely, if collector current decreases, there is less voltage developed across R-3 and the effective forward bias increases which, in turn, increases collector current. Hence, adding an emitter resistor will stabilize a transistor with respect to collector current variations which may occur for a variety of reasons. The most common being an increase in collector current as a function of an increase in temperature.

From a servicing standpoint, the voltage drop across the emitter resistor is a very important clue for determining circuit operation. A higher than normal emitter resistor voltage would generally indicate excessive collector current which could be due to a shorted transistor or a bias defect. A lower than normal emitter resistor voltage would generally indicate an open transistor or bias defect.

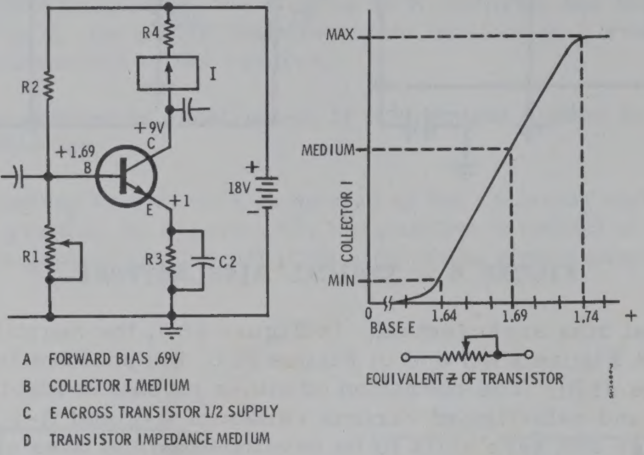


FIGURE 8 - TYPICAL CLASS A SILICON TRANSISTOR STAGE

Figure #8 shows a typical transistor stage adjusted for Class A or linear operation.

In this stage, one of the bias resistors (R-1) is shown as an adjustable one that might be used to establish a bias voltage so that some desired collector current will flow. This control can also be used to show how the transistor amplifies the input signal.

The base voltage - collector current curve in Figure #8 shows the collector current for several different bias voltages. The horizontal line shows several bias voltages developed across bias resistor, R-1. The vertical line shows values of collector current for each value of bias. For the moment, we will neglect the effect of the emitter resistor, R-3.

Note first the mark on the bottom line indicating 1.64V. This actually means .64 volts between the base and emitter since the emitter is at +1V. This mark corresponds with a line on the vertical column marked "minimum" as indicated with dotted lines. This means that with .64V forward bias, only a small amount of collector current will flow.

If R-1 is re-adjusted to cause the base to become +1.69 volts (.69V between base and emitter), the collector current will increase. Referring again to the curve, we see that the collector current has increased to the mark on the vertical column marked "medium".

If R-1 is re-adjusted to cause the base to become +1.74V (.74V between base and emitter), there will be a further increase in collector current. The curve now shows the current through the transistor to be maximum.

From this we can see that by adjusting the base voltage, we can cause any desired value of collector current. In actual practice, the emitter voltage would not remain a constant 1V with different values of collector current. As mentioned earlier, this voltage will always try to counteract any DC current change through the transistor. For explanation purposes, this voltage change was neglected. Its only effect would be that we would have to make a greater change in the voltage across R-1 in order to realize the changes in collector current indicated. How much more will depend on the transistor and the value of the emitter resistor.

Consider now how alternating signals fed to the base element can also cause collector current changes. Referring again to Figure #8, we re-adjust R-1 to cause the base to be +1.69V. This causes a collector current that corresponds to "medium" on the curve. Note that the current meter in the collector circuit is reading center scale. The collector current through R-4 causes a voltage drop so that approximately one-half of the supply voltage appears at the collector. These are the necessary conditions for a linear stage (can amplify without excessive distortion). Since both the collector voltage and collector current are medium values, they can be caused to increase and decrease the same amount with changes in base voltage.

Figure #9 shows two circuits similar to Figure #8. R-1 was adjustable in prior drawing for explanation purposes only. Once a correct value is chosen, it can be and usually is a fixed resistor.

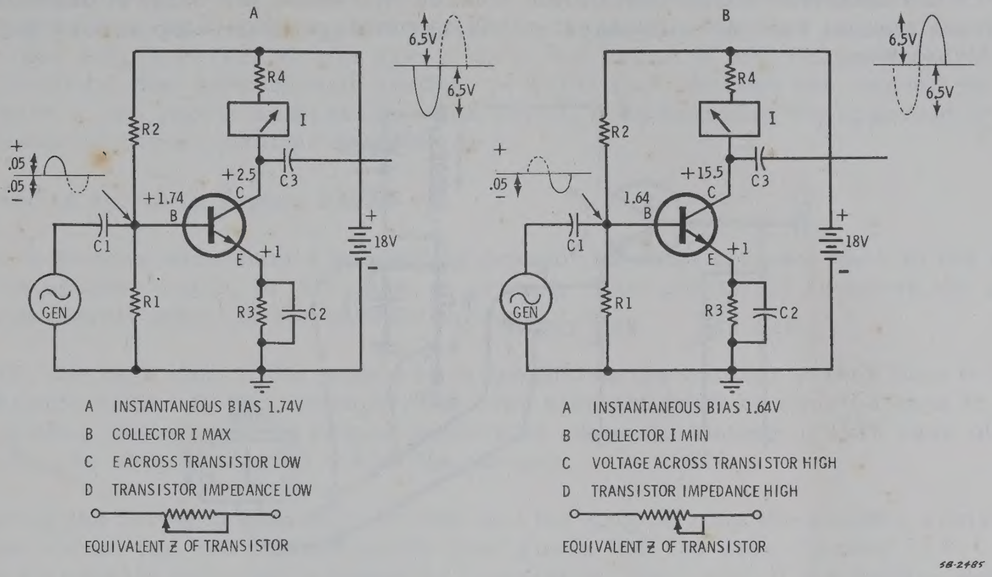

A
6.5V
6.5V
R4
I
R2
+.05
.05-
+2.5
C
C3
+1.74
B
+
18V
-
C1
E
+1
GEN
R1
R3
C2
A INSTANTANEOUS BIAS 1.74V
B COLLECTOR I MAX
C E ACROSS TRANSISTOR LOW
D TRANSISTOR IMPEDANCE LOW
EQUIVALENT Z OF TRANSISTOR
B
6.5V
6.5V
R4
I
R2
+
.05-
+15.5
C
C3
1.64
B
+
18V
-
C1
E
+1
GEN
R1
R3
C2
A INSTANTANEOUS BIAS 1.64V
B COLLECTOR I MIN
C VOLTAGE ACROSS TRANSISTOR HIGH
D TRANSISTOR IMPEDANCE HIGH
EQUIVALENT Z OF TRANSISTOR
58-2485

FIGURE 9 - SIMPLIFIED TRANSISTOR AMPLIFIER STAGE

In Figure #9, an AC generator has been connected to supply a signal between the base of the transistor and chassis ground. This signal at any instant will add or subtract from the DC bias that is supplied by the bias resistors R-1 and R-2. Capacitor C-2 provides an AC short across R-3 at the signal frequency.

In Figure #9 (first example), the generator is passing through its maximum positive excursion and is producing a peak +.05V. This voltage will add to the +1.69V DC bias voltage and cause a total instantaneous voltage between base and ground of +1.74V. From the curve in Figure #8, we see that this corresponds to maximum current through the transistor. This is indicated by the current meter connected in series with the collector of the transistor.

The increased current through R-4 causes a larger voltage drop so that for an instant the collector voltage drops to approximately 2.5V.

Figure #9 (second example), shows the result of the negative half cycle of the generator. This negative .05V excursion subtracts from the 1.69 bias so that for an instant the voltage between base and ground is 1.64V. The curve in Figure #8 shows that this corresponds to minimum collector current. The reduced current causes a smaller voltage drop across R-4 and allows the collector voltage to rise to approximately +15.5V.

From this we can see that an input signal of .1V PP can cause a collector or output signal of 13V PP. The DC voltage and AC voltage excursions shown in this example are somewhat representative of all silicon transistor circuits and serve to demonstrate the principles involved. Capacitor C-2 is usually large enough to by-pass R-3 so that the AC signal is not lost across this resistor. The voltage at the emitter will, however, disclose any average current change through the transistor, making this voltage a very important consideration when servicing a transistor stage. If the voltage is too high (compared to value in service manual), the transistor current is too large. If it is too low, the current is too low.

The circuits discussed so far are linear ones for minimum distortion to the input signal. These are the most common but by no means the only application for transistors. In some cases, the transistor may be used as an electronic switch. In this case, the stage may not have a DC forward bias circuit but uses a driving signal on the base to turn it on (heavy collector current) at the desired time and off when no signal is present. These variations will be discussed in the individual circuit descriptions.

Incidentally, here is an easy way to remember what constitutes an "on" signal for a transistor. If the driving signal has the same polarity as the base material, it is an "on" signal. An example of an "on" signal would be if you fed a positive going signal to an NPN transistor. Driving signals of the opposite polarity will turn the transistor off.

CHECKING A TRANSISTOR STAGE WITH THE TRANSISTOR IN PLACE

In transistor circuits, many defects can be localized by measuring the voltage on the transistor elements, since the defective component in many cases will upset the current drawn by the stage. This change from normal current will cause a different voltage to develop across the resistive components in the circuit.

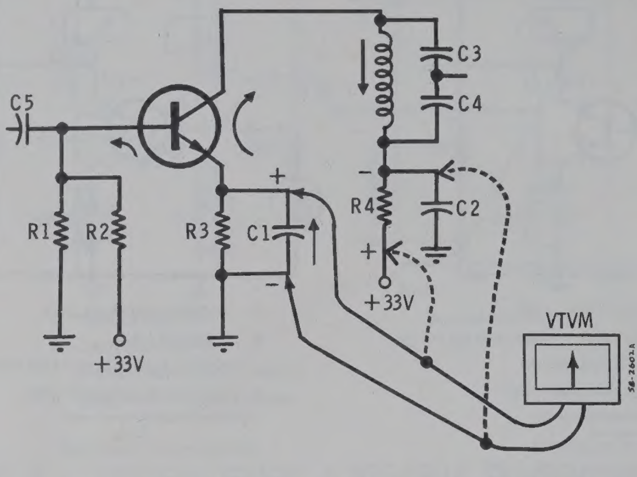


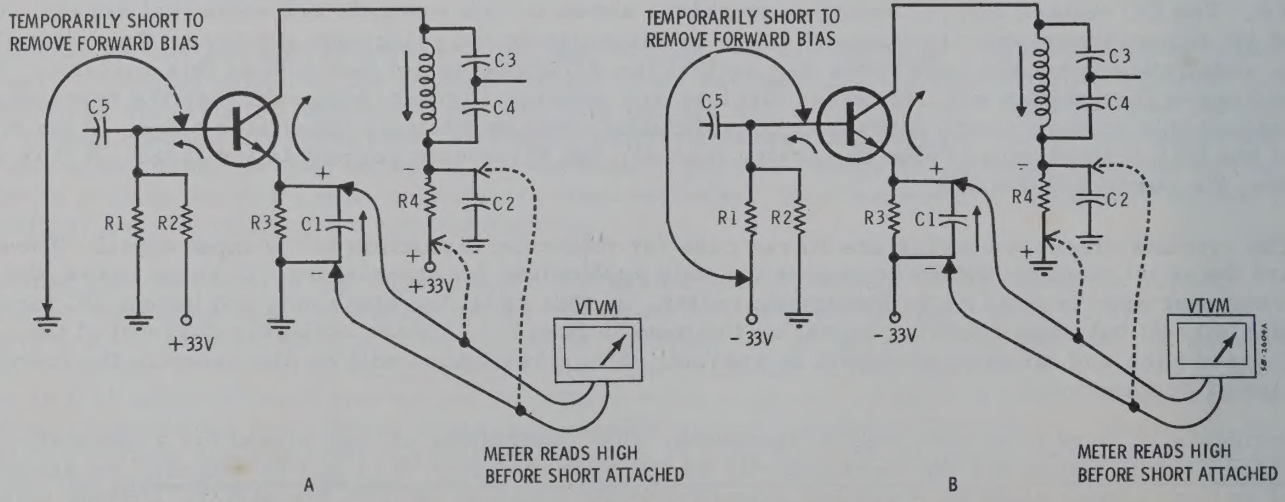
FIGURE 10 - CIRCUIT CONNECTIONS FOR MEASURING VOLTAGE

Figure #10 shows a typical transistor circuit with the necessary meter connections for measuring voltage drop as a result of transistor current. Electron flow is normally in the direction indicated by the arrows and causes the polarity of voltage drop across the resistors as shown.

The emitter resistor is common to both the input and output circuits and the voltage drop across the resistor is the sum of the total transistor base and collector current. The voltage drop across this resistor, therefore, becomes a good indicator of transistor current. The collector current can be determined separately if desired by metering the voltage drop across the decoupling resistor R-4.

If a circuit irregularity is indicated by an incorrect voltage across the emitter resistor R-3, as compared to the service manual, it then becomes desirable to know if the transistor is capable of controlling its current. If we can determine that the transistor base is not capable of controlling current, we would suspect that the transistor is defective. If we find that the base is capable of controlling current, we would then suspect that the stage is biased incorrectly indicating a defective bias resistor or other component such as a shorted coupling capacitor.

We can determine if the transistor base is capable of controlling the current by temporarily adding to or subtracting from the bias voltage and noting if there is a corresponding change in voltage drop across the emitter resistor R-3.


TEMPORARILY SHORT TO REMOVE FORWARD BIAS

METER READS HIGH BEFORE SHORT ATTACHED

A

TEMPORARILY SHORT TO REMOVE FORWARD BIAS

METER READS HIGH BEFORE SHORT ATTACHED

B

FIGURE 11 - TEMPORARILY REMOVING FORWARD BIAS

Figure #11 shows two examples where the transistor current is high as indicated by an excessive voltage drop as measured across the emitter resistor R-3 or collector resistor R-4. Since the current is high, we should temporarily remove the forward bias from the stage and determine if this will reduce the voltage drop across R-3. One simple way of removing forward bias would be to simply short the base and emitter elements of the transistor together using a small screwdriver. This may not, however, always give a clear indication of current control. If the value of R-2 is small, current may flow through emitter resistor R-3, through the shorted junction, through R-2 back to the supply and can, in some cases, even increase the apparent transistor current as measured across emitter resistor R-3.

A better method is shown in Figure #11A.

A short piece of jumper wire should be used to connect the base element back to the same source potential as the emitter which, in this case, is ground. This positively removes any forward bias without the undesirable effect of the current through R-2.

In Figure #11B, the high side of the supply is connected to the emitter rather than to the collector as shown in Figure #11A. In this example, the base element must be shorted back to the high side of the supply rather than ground to reduce transistor current. Notice in each case in Figure #11, bias resistor R-1 is simply shorted out by the jumper.

If after removing the forward bias as indicated and the drop across the emitter resistor does not reduce to a low value, you can make a pretty good guess that the base element is not able to control the current and probably indicates a defective transistor. However, if the voltage drop across the emitter resistor does drop to a very low value, it indicates that the base is capable of controlling current, the transistor is probably good and the defect is likely to be a biasing component such as R-1, R-2 or shorted C-5.

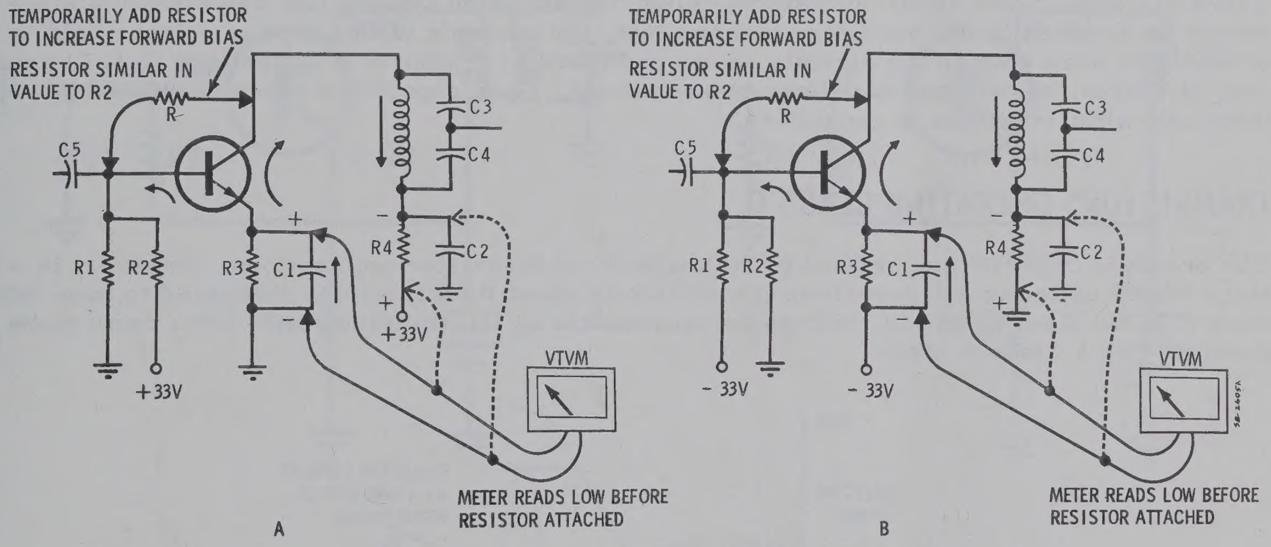

TEMPORARILY ADD RESISTOR TO INCREASE FORWARD BIAS
RESISTOR SIMILAR IN VALUE TO R2
R
C5
C3
C4
C2
R1
R2
R3
C1
R4
+
-
+33V
+33V
VTVM
METER READS LOW BEFORE RESISTOR ATTACHED
A
TEMPORARILY ADD RESISTOR TO INCREASE FORWARD BIAS
RESISTOR SIMILAR IN VALUE TO R2
R
C5
C3
C4
C2
R1
R2
R3
C1
R4
- 33V
- 33V
VTVM
METER READS LOW BEFORE RESISTOR ATTACHED
B

FIGURE 12

If measuring the voltage drop across R-3 discloses an abnormally low reading, it is desirable to temporarily increase the forward bias to determine if the base element is capable of controlling the current. This procedure is shown in Figure #12. The base element should be temporarily connected to the collector element through a series resistor R that is similar in value to bias resistor R-2. In this instance, the same basic procedure is used regardless of how the supply is connected to the transistor. Obviously, it should be ascertained that collector voltage is present when making check.

If the transistor base element has control of the current, connecting the resistor as shown should cause an increase in the voltage drop across resistor R-3. This indicates that the transistor is probably good and a biasing defect such as R-1, R-2 or shorted C-5 is indicated. If attaching the resistor as indicated does not increase the current, an open transistor is indicated.

One caution should be observed when effecting a removal of forward bias to evaluate transistor action. Since removing forward bias turns off collector current, the collector voltage rises to its supply voltage and there is a possibility of this voltage exceeding the breakdown voltage on the transistor. While this condition will not exist on the TS-594 chassis, it can become important if this technique is applied on other transistorized circuitry. A good rule to apply in these cases is to note the presence and value of collector load and emitter resistors which will govern the amount of current that will flow if the breakdown voltage is exceeded. If these resistors will limit the current to a value within the power dissipation of the transistor, there is little likelihood of damage if the breakdown voltage is slightly exceeded for a brief interval.

As experience is gained in this "in circuit transistor testing", the procedure for most transistors will simplify to the following.

Measure collector voltage. If it is lower than the supply voltage, the transistor is conducting. With the meter still on the collector, short the base and emitter together. If the collector voltage rises to the supply voltage, the transistor is not shorted and is capable of being turned off. This simplified procedure will not work in all cases, i.e., a collector connected to ground, but as experience in servicing transistor circuits is gained, it becomes easier to see where this technique is applicable and it certainly is a fast, simple way to evaluate a transistor without removing it from the circuit.

Once it is clearly determined that the current through a particular stage is incorrect, it is usually advisable to remove the transistor. This will allow you to both check the transistor and be able to measure the bias resistor values without the inaccuracies of having the transistor junctions across them. Every effort should be made to determine that a particular stage does contain a defect before any attempt is made to remove the transistor.

There are other types of circuit defects called "signal path" defects that can disable a stage and cannot be detected by DC voltage measurements. An example of this type of defect would be any one of the capacitors open in the circuits shown in Figure #11. Shorts in capacitors C-1, C-2 and C-5 can, of course, be detected in voltage measurement. Open capacitors are best located by paralleling them with similar values of capacitors.

TRANSISTORS OPERATING CLASS C

The previous material has related to the majority of transistor applications. However, in a Class C stage where collector current flows for relatively short time intervals compared to time intervals when it is not flowing, the DC voltage measurements on the transistor will differ from those on measured on a Class A stage.

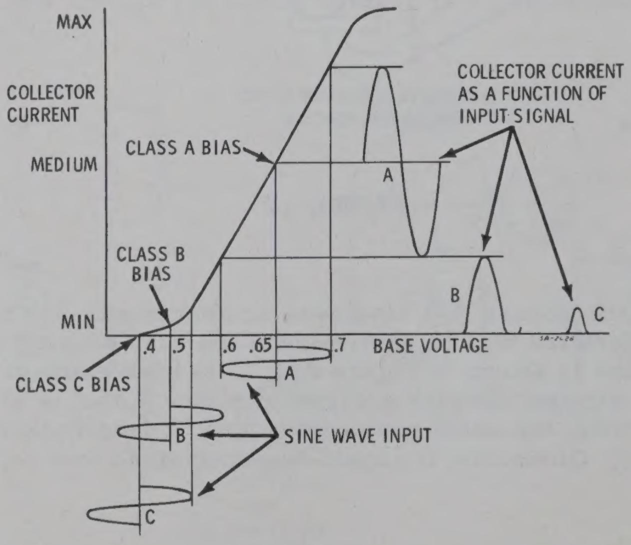


FIGURE 13 - OUTPUT CURRENT AS A FUNCTION OF CLASS A, B & C OPERATION

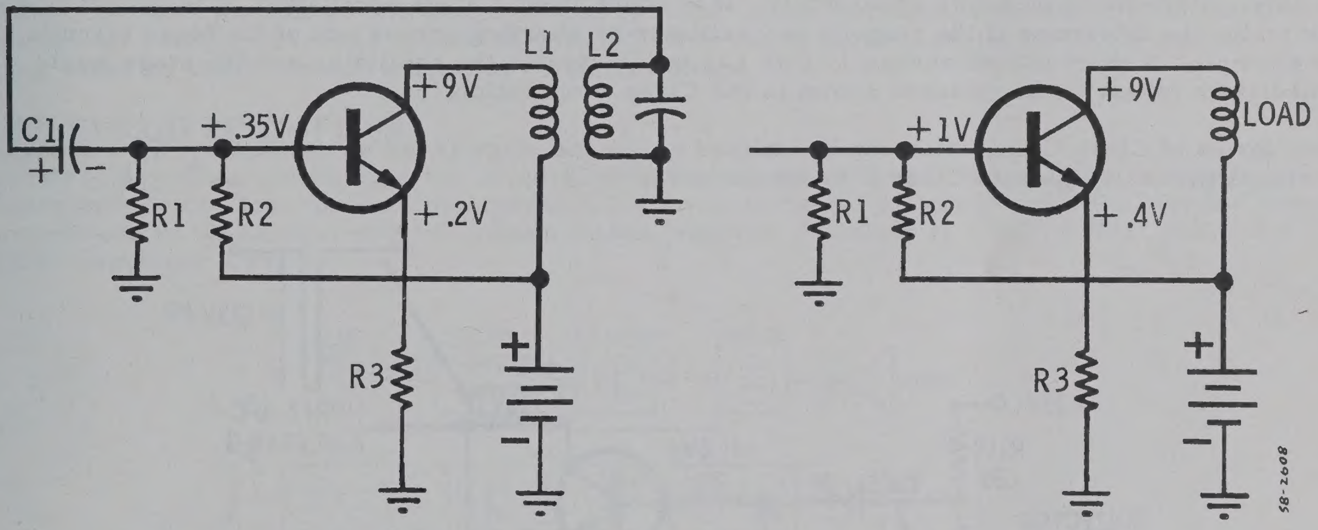
Figure #13 shows how the collector current will vary as a function of base voltage and input signal. The input signal is the same magnitude in all three cases. When the base voltage is .65 volts, the input signal adds to and substracts from the base voltage and a linear output is obtained. This is Class A operation and the average collector current is a constant value. When no signal is being received collector current is at the medium value.

When the base voltage is .5 volts, only the positive going half cycle of the input signal effectively adds to the base voltage causing a increase in collector current. The negative portion of the input signal drives the transistor into cut-off. This can be likened to Class B operation where collector current flows for only one-half the cycle when signal is applied and is at a very low or zero value when no signal is applied. Class B operation is often applied in battery operated devices where battery drain is an important consideration since the Class B circuit uses current in proportion to the signal being received, i.e., no signal results in little or no collector current.

When the base voltage is .4 volts, the transistor is in cut-off and no collector current flows. Only the most positive portion of the input signal causes collector current which is in pulses representing the positive peaks of the input signal. A Class C stage is usually biased into cut-off so no collector current flows until the input signal turns the stage on. Sync clippers are generally Class C stages.

It becomes apparent that the amount of base to emitter voltage or forward bias measured on a stage will be a function of whether the stage is operating Class A, B or C.

To demonstrate how voltages will vary from a Class A stage to a Class C stage, the circuit in Figure #7A can be made into an oscillator as shown in Figure #14.



TRANSISTOR OSCILLATOR

CLASS A TRANSISTOR STAGE

FIGURE 14

Resistors R-1 and R-2 form a voltage divider to provide +.6 volt forward bias on the base, however, at the instant that collector current starts to flow, a voltage is induced in the secondary winding of the collector coil (L-2) which is increasing in a positive direction. This positive voltage is coupled to the base by C-1 and results in an increase in forward bias which increases collector current which, in turn, increases the positive voltage developed across L-2 and more positive voltage is coupled back to the base. This action continues until collector current is maximum and no longer changing. At this time, the magnetic field around L-1 and L-2 starts to collapse which causes a negative going voltage to be developed across L-2 and this voltage coupled to the base reduces the forward bias and the transistor collector current starts to decrease which causes more negative voltage to be developed across L-2 and this is continued until the transistor collector current is reduced to zero. At this time, the cycle now starts to repeat itself and the circuit becomes an oscillator.

To evaluate this overall effect on DC base voltage as measured to ground, it is necessary to evaluate the action of C-1. When the feed-back voltage is positive, electrons flow through R-3, emitter/base junction, C-1 and L-2. This charges up C-1 as shown. A discharge path for C-1 is through R-1 and since this is a higher impedance path than the charge path, the capacitor will retain a negative charge over most of the cycle. This negative charge subtracts from the forward bias and in the circuit in Figure #14, a meter would read .35 volts on the base and could lead to the assumption that the transistor is "turned off" due to insufficient forward bias. In addition, a DC meter measuring emitter voltage would read .2 volts and in a Class A silicon transistor stage, a reading of .2 volts on the emitter and .35 volts on the base is indicative of a shorted transistor. However, if the stage is an oscillator, it is a normal set of readings. Base voltage is low because of the charge on C-1 and some emitter voltage is normal due to the pulses of collector current when the transistor is turned on. The meter reads the average DC value of emitter/collector current so it is normal to have some emitter voltage in an oscillator.

It is a good rule to consult the schematic diagram to determine the correct operating voltages. In the absence of a schematic, it becomes necessary to determine the transistor mode of operation and evaluate voltage measurements accordingly. If in doubt about a stage oscillating, it is generally an easy matter to determine if the stage is an oscillator by shorting across one of the tuned circuits. For example, a short placed across L-1 or L-2 would disable the oscillator and the stage would immediately revert to the voltages shown in the Class A operation.

Other forms of Class C operation can be utilized where the stage is not an oscillator. Sync separator stages generally operate Class C as shown in Figure #15.

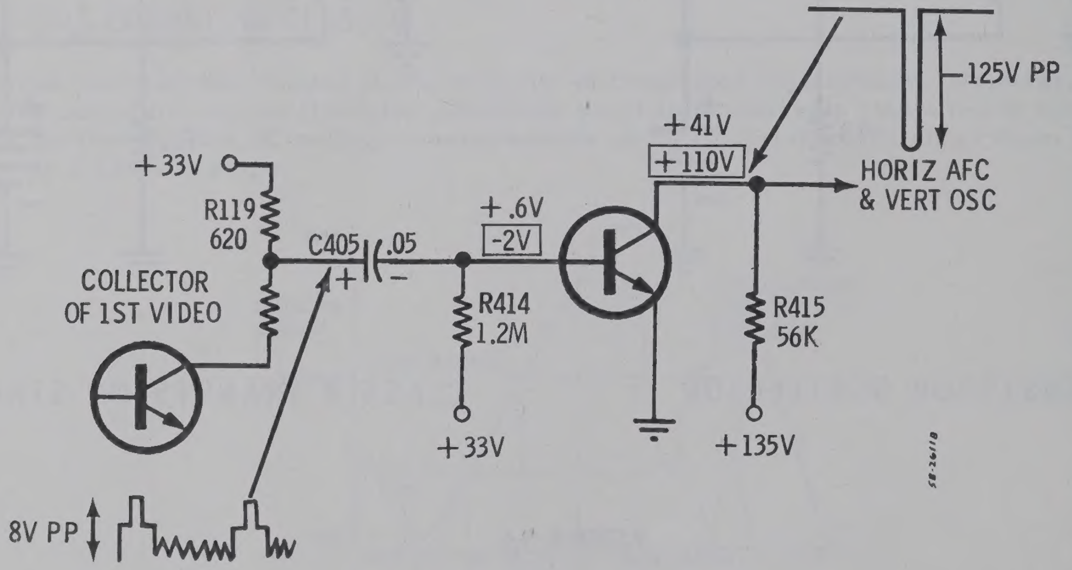


FIGURE 15 - SYNC CLIPPER CLASS C OPERATION

Voltages in the boxes represent with signal input and those on top of boxes represent no signal input. Note that with no signal input, the base/emitter is forward biased to +.6 volts as a result of electron flow through the emitter base junction and R-414. This turns the transistor on and approximately 1.7 mils of collector current flows as evidenced by +41 volts on the collector and a 94 volt drop across R-415.

When the positive going video signal is applied to the base, the forward bias is increased and electrons flow through the emitter/base junction, C-405 and R-119. This charges up C-405 as shown. The discharge path is through R-414, a 1.2 meg ohm resistor, so the capacitor discharges very little before it is again charged up as a result of sync pulse information. The net result is a negative charge on the capacitor that is proportional to the input signal. Only the most positive portions of the input signal are sufficient to overcome this bias and drive the transistor into conduction. Hence, only the sync pulse information, reversed 180 degrees is seen in the collector circuit.

Note the boxed voltages representing with signal operation. The base is apparently reverse biased -2V with respect to the emitter and yet collector current is flowing as evidenced by the +110 volts on the collector indicating a 25 volt drop due to collector current across R-415.

Here again, if voltages measured with signal were related to those normally encountered in Class A operation, the result could be a search for a non-existing malfunction. Once again the importance of comparing measured voltages against specified voltages is demonstrated to be a good service practice.

Incidentally, although scope checks are the best checks for a sync separator, proper bias operation can be determined by switching to a local channel (to apply signal) and an unused channel (no signal) and noting corresponding voltage changes.

It is important to note that the voltages measured will be a function of signal conditions. For example, the value of negative voltage or reverse bias will be proportional to the strength of the signal. The stronger the signal, the more negative the voltage. Also, collector voltage with no signal will be a function of noise. For example, if noise is reduced by turning the channel selector between channels, the voltage will range around 10 volts. When turned to an unused VHF channel, the collector voltage will range around 40 volts. This is due to noise charging up C-405 and reducing collector current which increases collector voltage.

TS-594 CIRCUIT DESCRIPTION

Figure #16 depicting a block diagram of the TS-594 chassis shows how 12 transistors, 12 diodes, 1 Zener and 10 tube functions are incorporated. A power transformer supplies 6.3V AC for the tube filaments and in conjunction with two silicon diodes, supplies B+ values of +285V, +270V, +135V and a Zener regulated +33V.

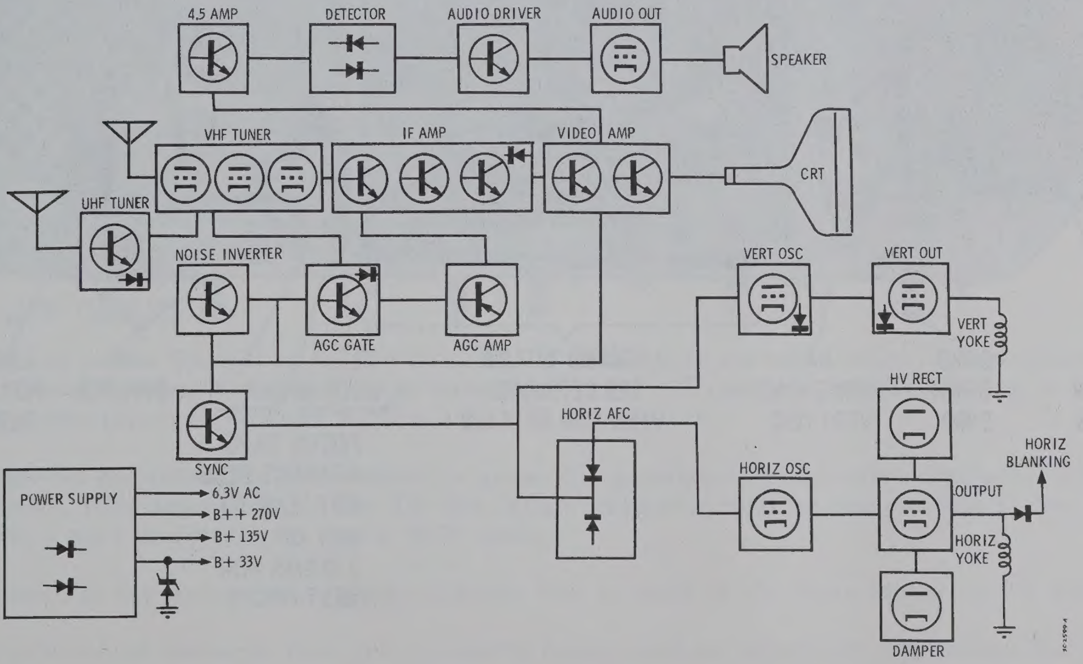


FIGURE 16 - BLOCK DIAGRAM OF TS-594

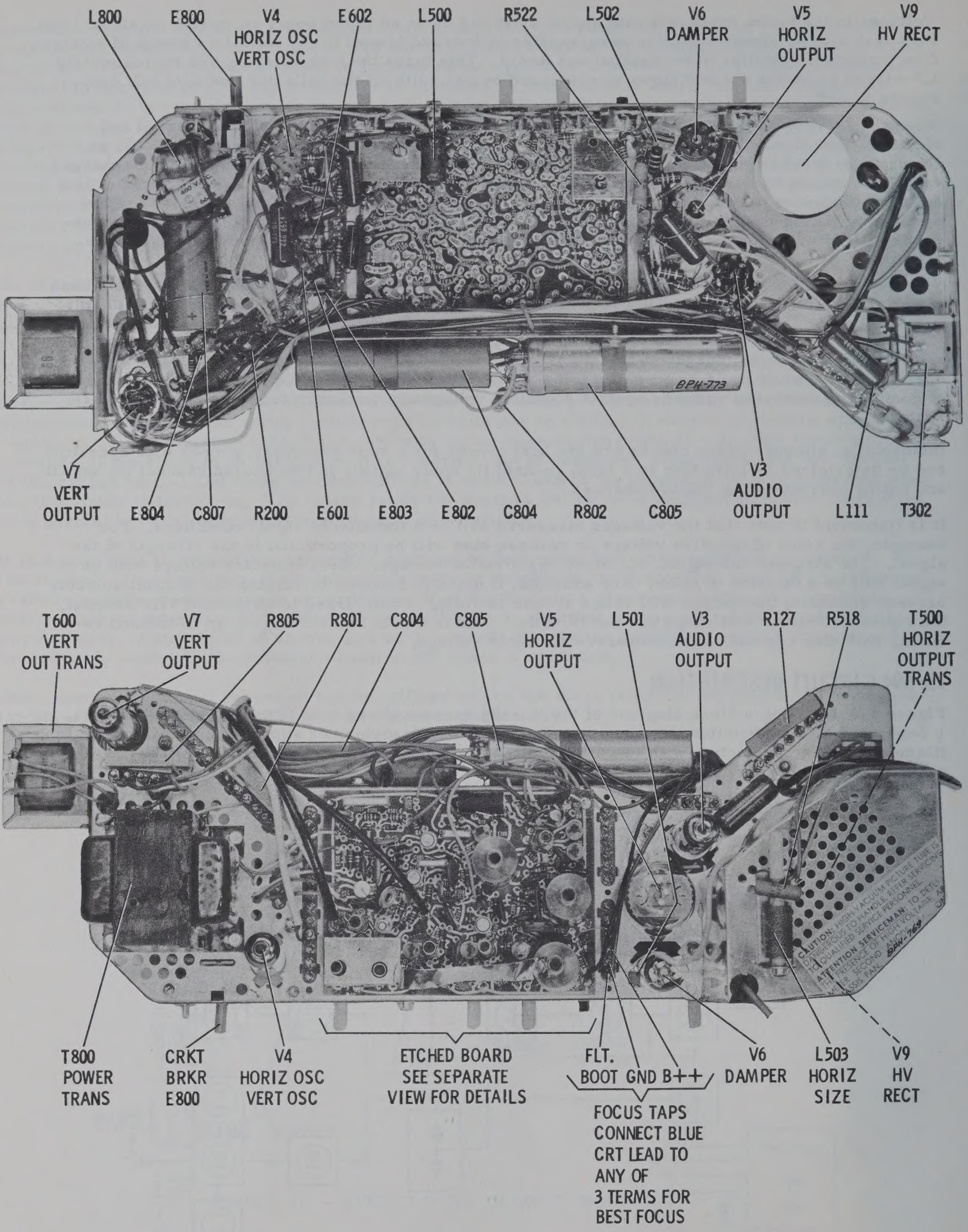

L800
E800
V4 HORIZ OSC VERT OSC
E602
L500
R522
L502
V6 DAMPER
V5 HORIZ OUTPUT
V9 HV RECT
V7 VERT OUTPUT
E804
C807
R200
E601
E803
E802
C804
R802
C805
V3 AUDIO OUTPUT
L111
T302
BPH-773
T600 VERT OUT TRANS
V7 VERT OUTPUT
R805
R801
C804
C805
V5 HORIZ OUTPUT
L501
V3 AUDIO OUTPUT
R127
R518
T500 HORIZ OUTPUT TRANS
T800 POWER TRANS
CRKT BRKR E800
V4 HORIZ OSC VERT OSC
ETCHED BOARD SEE SEPARATE VIEW FOR DETAILS
FLT. BOOT GND B++
FOCUS TAPS CONNECT BLUE CRT LEAD TO ANY OF 3 TERMS FOR BEST FOCUS
V6 DAMPER
L503 HORIZ SIZE
V9 HV RECT
BPH-769

FIGURE 17 - BOTTOM & TOP VIEW OF TS-594 CHASSIS

Figure #17 shows a top and bottom view of the TS-594 chassis. Note that a number of test points are available on the top of the chassis.

Tubes are used in the VHF tuner, sweep oscillators and output systems and the audio output stage. Solid state devices are used in all other applications which, for the most part, consist of low voltage/low power applications.

Since the tube circuitry is very similar to and in many cases identical to circuits that you are familiar with in other current Motorola receivers, it will not be discussed in great detail. Test points and other applicable service shortcuts, however, will be indicated.

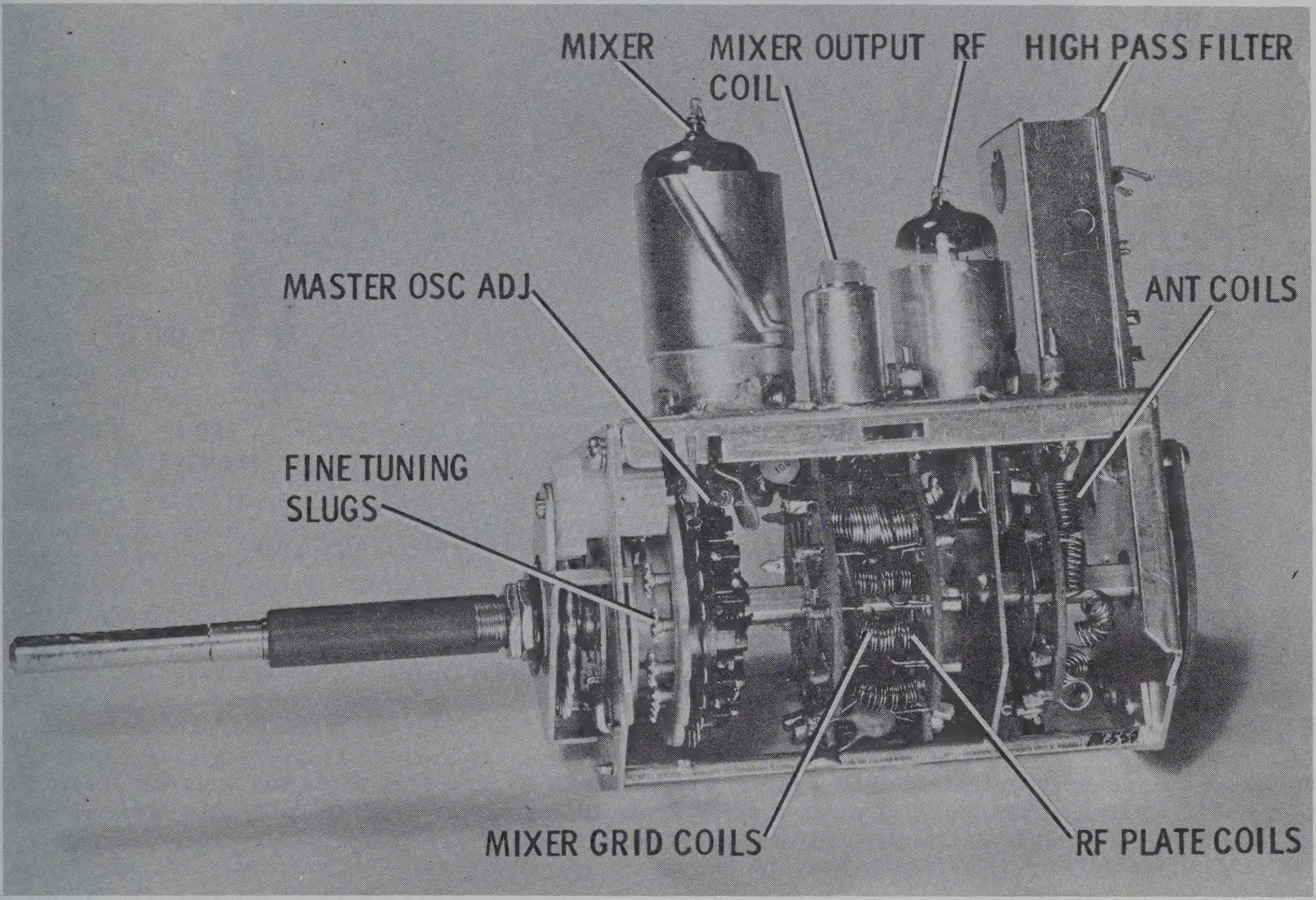


FIGURE 18 - VHF TUNER - OPTT-396

VHF AND UHF TUNERS

The VHF tuner in the TS-594 is the OPTT-396. It is the four circuit switch type similar to tuners currently in use in other black and white tube receivers. Off-set pre-set fine tuning is used. The various adjustments are shown in Figure #18.

Since the usable sensitivity of a receiver is generally governed by the noise characteristics of the VHF tuner, it is apparent that the TS-594 fringe reception will be comparable to the TS-589 chassis which uses basically the same VHF tuner.

The UHF tuner is the same transistorized tuner that is used in all other Motorola TV receivers.

The same service procedures that are currently being used on tuners should suffice for any tuner service on the TS-594 chassis.

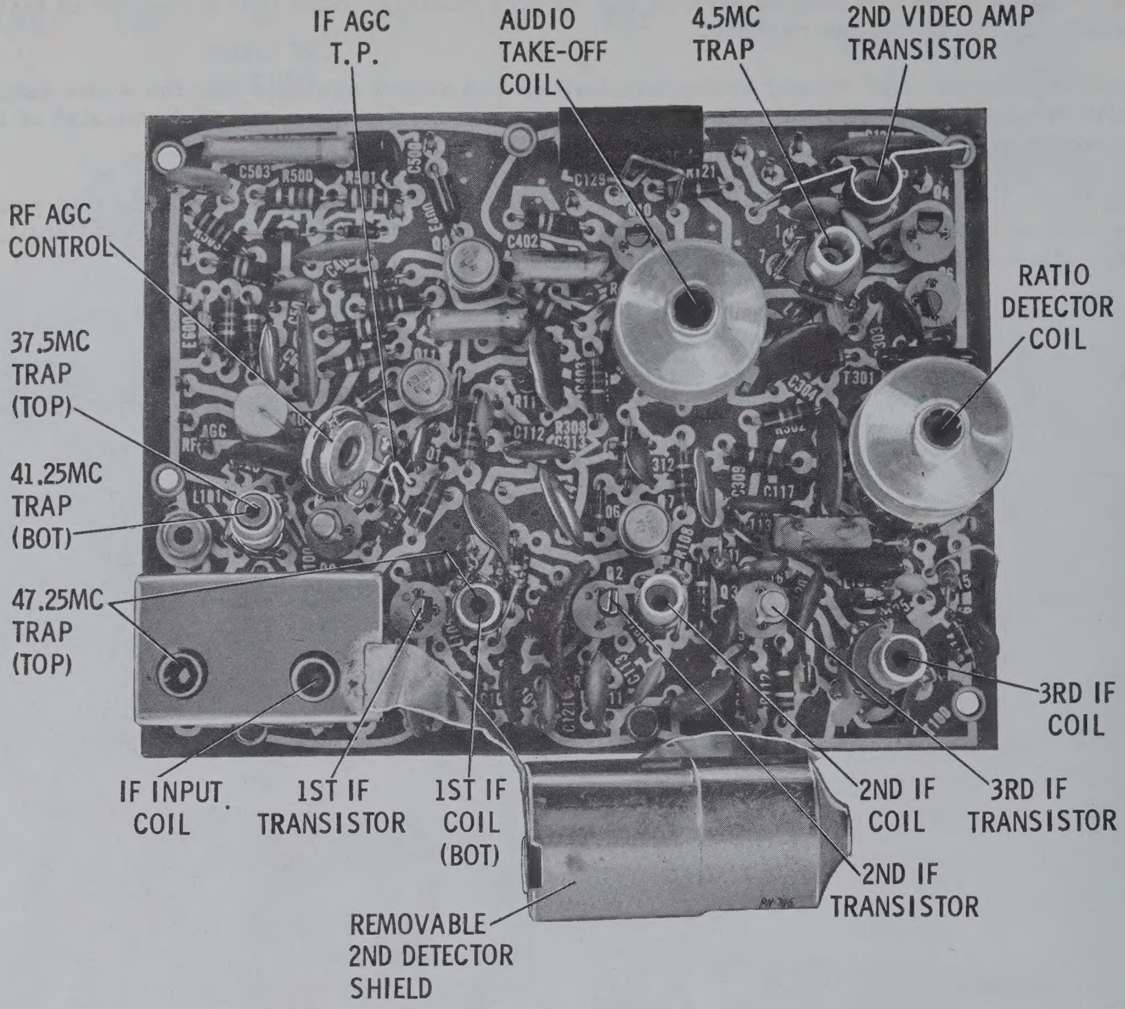

IF AGC T.P.
AUDIO TAKE-OFF COIL
4.5MC TRAP
2ND VIDEO AMP TRANSISTOR
RF AGC CONTROL
RATIO DETECTOR COIL
37.5MC TRAP (TOP)
41.25MC TRAP (BOT)
47.25MC TRAP (TOP)
3RD IF COIL
IF INPUT COIL
1ST IF TRANSISTOR
1ST IF COIL (BOT)
2ND IF COIL
3RD IF TRANSISTOR
2ND IF TRANSISTOR
REMOVABLE 2ND DETECTOR SHIELD

FIGURE 19 - PICTURE OF ETCHED PANEL

VIDEO IF SYSTEM

The basic components in the video IF system are shown in Figure #19. Note the snap-on shield for the third IF (2nd detector) coil. This is a service aid incorporated to simplify analysis of the 2nd detector circuitry and in particular, the 2nd detector diode.

VIDEO IF SCHEMATIC (FIGURE #20)

The video IF system consists of three stages and is similar in many respects to the conventional tube system. All three stages are of the common emitter configuration. The input signal is applied between base and emitter and the output signal is between collector and base. This circuit configuration makes the base operation similar to the grid in a tube, the collector similar to the plate and the emitter similar to the cathode. Also, since the transistors are silicon NPN types, the polarity of the voltages is similar to tubes in that the collector has a positive voltage (similar to a tube plate) and current increases through the transistor as the base is made more positive (similar to less negative on a tube grid). The emitter resistor develops a positive voltage which is a function of collector current (similar to a cathode resistor).

The coupling circuit between the tuner and IF system is very similar to that used in a tube receiver and contains the usual 41.25Mc and 47.25Mc traps. In addition, a 37.5Mc trap is incorporated to afford upper adjacent channel video rejection. Maximum adjacent channel rejection is realized when this trap is tuned to approximately 37.5Mc. It is physically located on top of the 41.25Mc trap and easily accessible for any additional touch up in the field under actual signal conditions. However, when using sweep equipment on the IF, the trap should be set for 37.5Mc because this is where maximum rejection will occur.

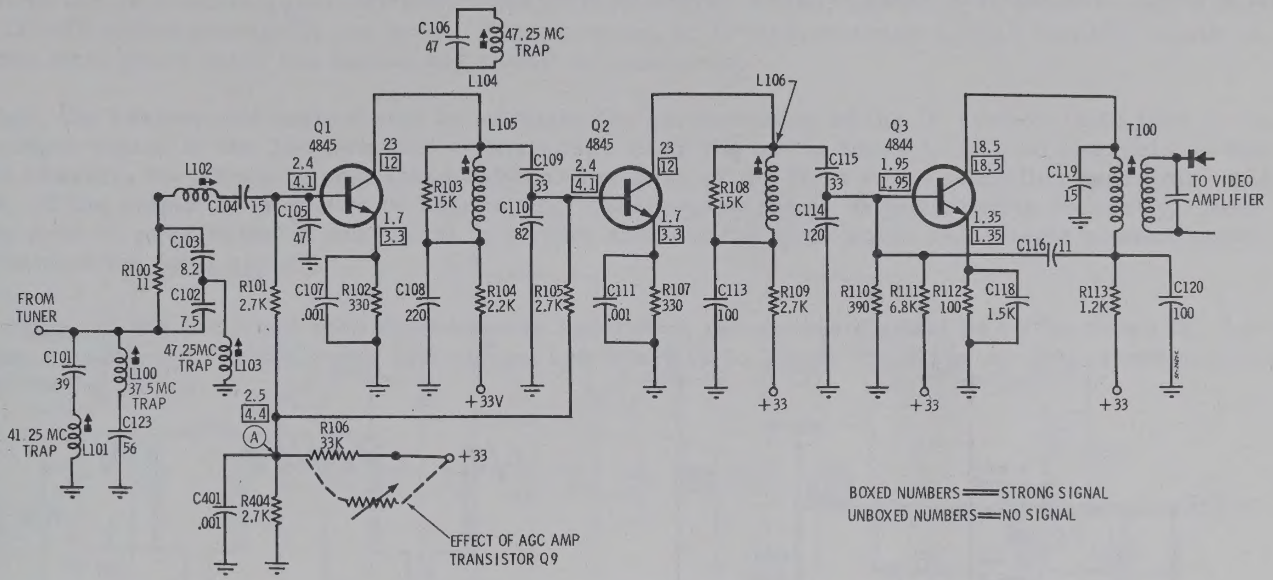

C106
47
47.25 MC TRAP
L104
L105
L106
Q1
4845
Q2
4845
Q3
4844
T100
L102
C104
15
C105
47
2.4
4.1
23
12
1.7
3.3
R103
15K
C109
33
C110
82
C107
.001
R102
330
C108
220
R104
2.2K
R105
2.7K
+33V
C111
.001
R107
330
R108
15K
C115
33
C114
120
C113
100
R109
2.7K
+33
1.95
1.95
18.5
18.5
1.35
1.35
C119
15
C116
11
R110
390
R111
6.8K
R112
100
C118
1.5K
R113
1.2K
C120
100
TO VIDEO AMPLIFIER
FROM TUNER
R100
11
C103
8.2
C102
7.5
R101
2.7K
C101
39
L100
37.5MC TRAP
47.25MC TRAP
L103
41.25 MC TRAP
L101
C123
56
2.5
4.4
A
R106
33K
C401
.001
R404
2.7K
EFFECT OF AGC AMP TRANSISTOR Q9
BOXED NUMBERS = STRONG SIGNAL
UNBOXED NUMBERS = NO SIGNAL

FIGURE 20 - THREE STAGE IF SYSTEM

L-102, C-104 and C-105 tune the base or input circuit of the 1st IF stage. The circuit is series resonant and C-104 blocks DC from the tuner to the base and in conjunction with C-105 effects a match to the base. All three IF transistors are NPN with a positive voltage applied to the collector with respect to the emitter. An emitter resistor is used in each stage for stabilization and is bypassed with a capacitor. Collector voltage is supplied from a regulated +33V buss through resistors which afford decoupling and control collector voltage under weak signal conditions when transistor current is at minimum and collector voltage will be the highest. Also, these resistors serve to reduce collector voltage as collector current increases. This reduction in collector/emitter voltage reduces gain. The AGC system can then affect a gain reduction by increasing forward bias voltage which increases collector current and causes a lower collector/emitter voltage which will reduce the output as a function of forward bias.

Neutralization or eliminating the tendency for oscillation is accomplished in the first two stages by degeneration. C-108 and C-113 do not afford complete bypassing across the collector resistors which results in some of the AC signal being developed across the resistors. This degenerates or reduces the gain of the stage.

The third IF stage is neutralized by C-116 which couples a small portion of the output back to the base to offset or neutralize the positive feedback from collector to base.

Note that if C-120 afforded complete bypassing, C-116 could not couple any signal back to the input. Therefore, C-120 does not afford complete bypassing and introduces a small amount of degeneration which further stabilizes the stage.

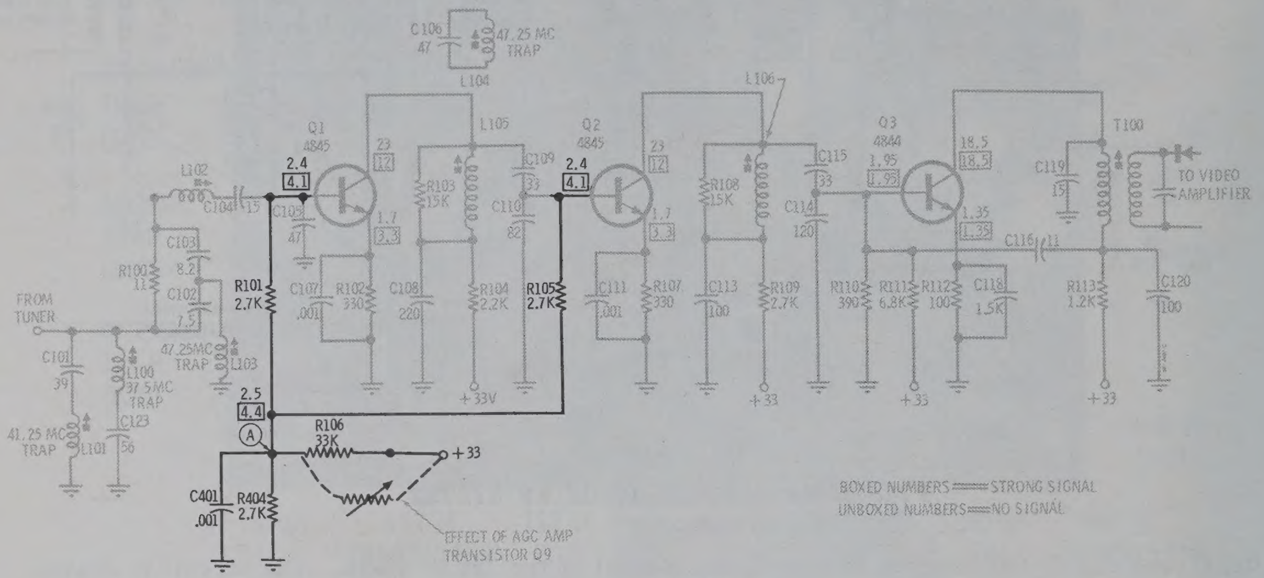
The output (or collector) circuitry for the first two stages is tuned to the center of the overall bandpass (approximately 44Mc). These coils L-105 and L-106 are very broad and contribute little to the overall selectivity of the system. Along with other circuit capacity, two capacitors in series are used to resonate L-105 and L-106 and offer a convenient method to capacity couple from one stage to the other and their ratio of one to the other can be selected to afford the desired signal transfer and matching to the next stage. Note that a second 47.25Mc trap is incorporated on the first IF coil to further attenuate lower adjacent channel sound to the desired level.

Selectivity in the overall system is accomplished by the traps in the input circuitry and the band width of the over-coupled 3rd IF or second detector transformer.

The video detector output is DC coupled to the base of the first video amplifier. Note that while the detector is connected to ground for AC (C-126), it is off ground for DC to establish forward bias for the first video amplifier (see Figure #25).

VIDEO IF AGC (FIGURE #21)

Since the first two IF stages are controlled by AGC, their forward bias source is controlled by the AGC system. The third IF stage is fixed biased by R-111 and R-110.


C106
47
47.25 MC
TRAP
L104
L106
Q1
4845
Q2
4845
Q3
4844
T100
L102
C104
15
2.4
4.1
23
12
1.7
3.3
L105
C109
33
C110
82
R103
15K
C105
47
C103
8.2
C102
7.5
R100
11
FROM
TUNER
C101
39
L100
37.5MC
TRAP
47.25MC
TRAP
L103
41.25 MC
TRAP
L101
C123
56
R101
2.7K
C107
.001
R102
330
C108
220
R104
2.2K
R105
2.7K
+33V
C111
.001
R107
330
R108
15K
C113
100
R109
2.7K
+33
C115
33
C114
120
1.95
1.95
18.5
18.5
1.35
1.35
C119
15
C116
11
TO VIDEO
AMPLIFIER
R110
390
R111
6.8K
R112
100
C118
1.5K
R113
1.2K
C120
100
2.5
4.4
A
R106
33K
+33
C401
.001
R404
2.7K
EFFECT OF AGC AMP
TRANSISTOR Q9
BOXED NUMBERS═STRONG SIGNAL
UNBOXED NUMBERS═NO SIGNAL

VIDEO IF AGC

FIGURE 21

In a tube system, the gain is generally controlled by increasing the negative bias on the control grid which reduces plate current and affects a reduction in gain. The same technique can be applied to transistors, i.e., reduce the amount of forward bias to reduce the gain of the stage. However, a gain reduction can also be accomplished with transistors by increasing the forward bias which increases collector current which will reduce gain. This latter method is called "forward AGC" and is used on the TS-594 chassis. How this is accomplished will be explained in the section on AGC. To understand the basic AGC effect on the IF, it is only necessary to accept the fact that an increase in forward bias will increase collector current which will reduce gain.

The forward bias networks for the AGC controlled stages (1st and 2nd IF) connect to the junction of R-106 and R-404 which form a voltage divider from +33 volts. A voltage in the order of +2.5 volts is developed at Point A under no signal conditions. This 2.5 volt bias source produces approximately .7 volts forward bias between base and emitter of the first two IF stages which provides maximum gain. When a signal is received, the AGC system acts as a variable resistor in parallel with R-106. The effect is to reduce the value of R-106 so more voltage will be developed at Point A. The voltage developed at Point A will be proportional to the strength of the signal received. A strong signal will produce more voltage than a weak one. A nominal value for a moderately strong signal (snow free) is a 4.4 volts. Note that with signal, the forward bias source voltage has increased to 4.4 volts from a no signal value of 2.5 volts. This results in a forward bias potential of .8 volt to be developed between base and emitter which increases collector current and reduces stage gain.

The voltage change between no signal and a moderately strong signal is shown on the diagram. Voltages "with signal" are shown in a box, while "zero signal" voltages are not in a box and are above the signal voltages.

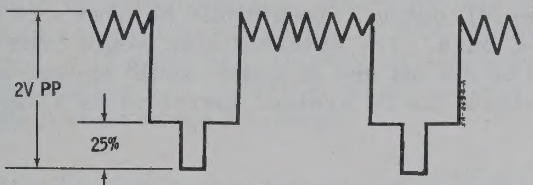
In actual practice, the variable resistor shown across R-106 is the AGC amplifier transistor and its effective impedance is electronically varied as a function of signal strength. This will be discussed in the AGC section.

SERVICING THE TRANSISTORIZED VIDEO IF

The first step in any servicing procedure is to localize the problem to one specific area of the set. Defects in the IF system generally affect the picture and/or sound, however, in some cases, a defect in the IF will affect primarily the sync. For example, an IF defect which causes limiting could remove the sync pulse from the signal and result in poor sync.

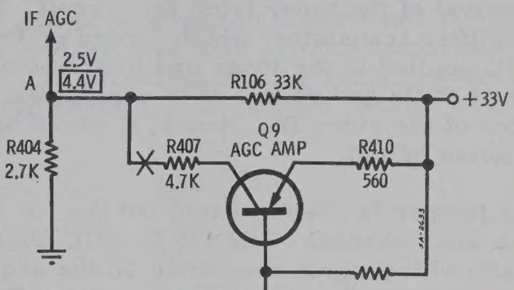
Probably, the easiest and fastest way to evaluate the performance of the IF system is to look at the video output signal at the 2nd detector with a scope when the set is tuned to a local channel. In the TS-594 chassis, the scope is connected between the base of the first video amplifier transistor and ground. If the output is as shown in Figure #22, chances are the IF is performing normally. Note that the peak to peak value of the signal is 2 volts and that the sync pulse represents approximately 25 percent of the total signal.

If the signal at the 1st video amplifier base is incorrect, the problem could be in the video IF, AGC, or video amplifier. The following techniques are intended to locate the stage or stages responsible for the malfunction.



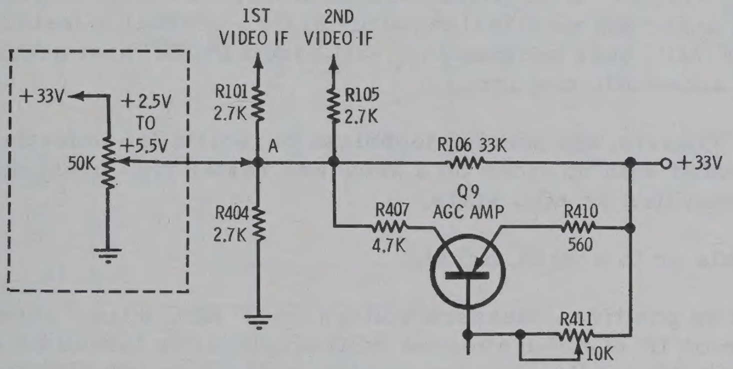
SIGNAL AT BASE OF 1ST VIDEO AMP

VIDEO DETECTOR OUTPUT



OPEN COLLECTOR CIRCUIT OF AGC AMP TO REMOVE ITS EFFECT ON VIDEO IF STAGES

SERVICING THE VIDEO IF SYSTEM



SET 50K POT TO PROVIDE +5V ON IF AGC BUSS (POINT A). ADJUST VIDEO AMP BIAS CONTROL (ON REAR OF CHASSIS) TO PROVIDE + 50V ON COLLECTOR OF 2ND VIDEO AMP WHEN IF AGC BUSS IS +5 VOLTS.

ROTATE 50K POT TO PROVIDE +5 TO +2.5 VOLTS ON AGC BUSS. IF PIX COMES IN, PROBLEM IS IN AGC. IF PIX DOES NOT COME IN, SET POT TO PROVIDE +2.5V ON IF BUSS AND ANALYZE IF FOR DEFECT.

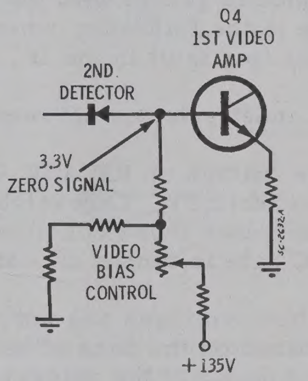


FIGURE 22 **SERVICING THE VIDEO IF SECTION**

A fast simple way to eliminate the AGC system as the source of the trouble is to turn the channel selector half way between channels and remove the effect of the AGC amplifier transistor (Q-9) by opening its collector circuit. This can easily be accomplished by clipping the lead on R-407 (4.7K) which is mounted on one end and has a long lead for this purpose. If opening this lead restores snow to the screen (indicating the receiver has normal gain), it is likely that the defect is in the AGC circuitry.

However, in the long run, much time will be saved if a form of external bias is applied to the IF AGC buss (Point A). This can be in the form of a battery connected so a variable potential of +2.5 volts to +5.5 volts is available or to use a potentiometer (exact value not critical but should be in the order of 30K to 50K ohms) wired so one end is connected to +33 volt buss and the other connected to ground. The arm of the potentiometer is connected to the IF AGC buss (Point A) and a variable source of positive voltage is available.

In either case, the external bias should be connected to Point A and adjusted to +5.5 volts bias with the tuner tuned between channels. The +5.5 volts bias reduces the IF gain so noise will not affect the 1st video amplifier bias. The video amplifier bias control should then be adjusted to provide +3.5 volts on the 1st video amplifier base. The video amplifier bias control should be able to swing the bias at least 1/2 volt above and 1/2 volt below the +3.5 volts. Failure to obtain the +3.5 volts or the correct bias voltage range on the base of the 1st video amplifier is indicative of a defect in the video amplifier stages, noise inverter or 2nd detector coil and this should be resolved before continuing analysis on the video IF system.

After the 1st video amplifier base voltage has been set for +3.5 volts, a scope should be connected to the base of the 1st video amplifier. There will now be two indicators of IF output, the scope and the CRT screen. However, the CRT screen cannot be considered a positive indicator of IF operation or output unless it has been ascertained that the video amplifier stages are operating normally and up to this point it has not yet been established that they are operational.

With the channel selector still in the between channel position, the next step is to vary the external bias on the IF AGC buss (Point A) from +5.5V to +2.2V and check for noise on the scope or CRT as the IF AGC bias is varied. If noise appears while the IF AGC bias is varied through its normal operating range (+5V to +2.2V) the defect is probably in the AGC system and it should be investigated. If noise is not present as the IF AGC bias is adjusted through this range, the IF AGC bias should be set for +2.5 volts and the IF stages analyzed with this fixed bias on the AGC buss.

The reason for turning the channel selector between channels in the preceding step is to affect a removal of the tuner from the circuit. If there was a circuit defect (such as a shorted 2nd video amplifier transistor) which turned on the AGC system to full output, there would be over - 20 volts AGC applied to the tuner and over +6 volts to the IF AGC buss. The external bias would over ride the +6 volts and reduce it to normal but the tuner would be cut off and no noise would appear at the input of the video IF. Hence, it would be difficult to evaluate the IF system operation as a function of noise output.

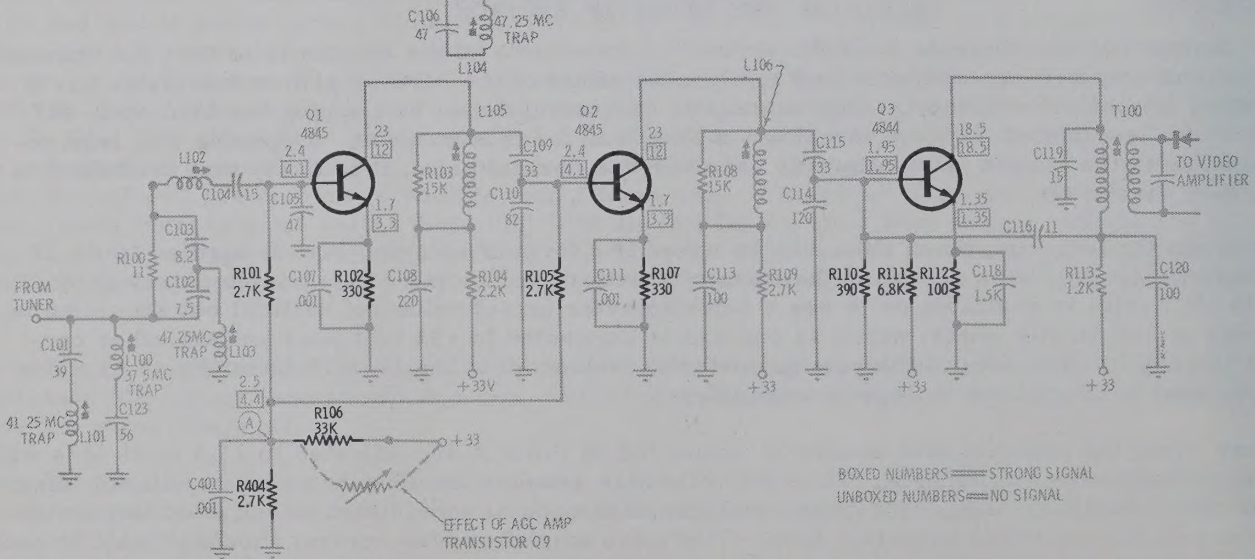
If a jumper is used to short out the RF AGC input on the tuner, the channel selector could be tuned to a weak channel while the IF AGC buss was varied from +5.5 volts to + 2.2 volts. Then, if a composite video signal was noted on the scope or a picture appeared on the CRT while the IF AGC was varied, the defect is probably in the AGC system. If no output was obtained, the defect is probably in the video IF and it should be analyzed under the no signal conditions, i.e., channel selector tuned between channels and +2.5 volts on the IF AGC buss because this will result in the most accurate voltage relationship between the set and schematic diagram.

As experience is gained with the TS-594 chassis, the service technique to isolate the defective stage may evolve to the following when confronted with no video on a snowless raster type problem which could be due to a fault in the IF, video amplifier or AGC stage.

1. Turn channel selector between channels or to a weak signal.

2. Measure voltage on RF AGC - should be positive. Measure voltage on IF AGC buss - should be in the order of +2.5V. Excessive voltage on IF AGC buss means AGC amplifier is turned on - it shouldn't be under these conditions. A negative voltage or low positive voltage on RF AGC buss means AGC gate is turned on - it shouldn't be under these conditions. Check AGC stages.

3. If AGC buss voltages are normal (Step #2), there should be an output at the 2nd detector so a scope is placed on the base of the 1st video amplifier. If an output is noted on the scope and no output noted on CRT, the defect is in video amplifier stages.


C106
47
47.25 MC
TRAP
L104
L105
L106
Q1
4845
Q2
4845
Q3
4844
L102
C104
15
C105
47
2.4
4.1
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12
1.7
3.3
R103
15K
C109
33
C110
82
C103
8.2
R100
11
C102
7.5
R101
2.7K
C107
.001
R102
330
C108
220
R104
2.2K
R105
2.7K
C111
.001
R107
330
R108
15K
C113
100
R109
2.7K
C115
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C114
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1.95
1.95
18.5
18.5
1.35
1.35
C116
11
C119
15
T100
TO VIDEO
AMPLIFIER
R110
390
R111
6.8K
R112
100
C118
1.5K
R113
1.2K
C120
100
FROM
TUNER
C101
39
L100
37.5MC
TRAP
47.25MC
TRAP
L103
C123
56
41.25 MC
TRAP
L101
2.5
4.4
A
R106
33K
+33
+33V
C401
.001
R404
2.7K
EFFECT OF AGC AMP
TRANSISTOR Q9
BOXED NUMBERS STRONG SIGNAL
UNBOXED NUMBERS NO SIGNAL

FIGURE 23 - BIAS PATHS

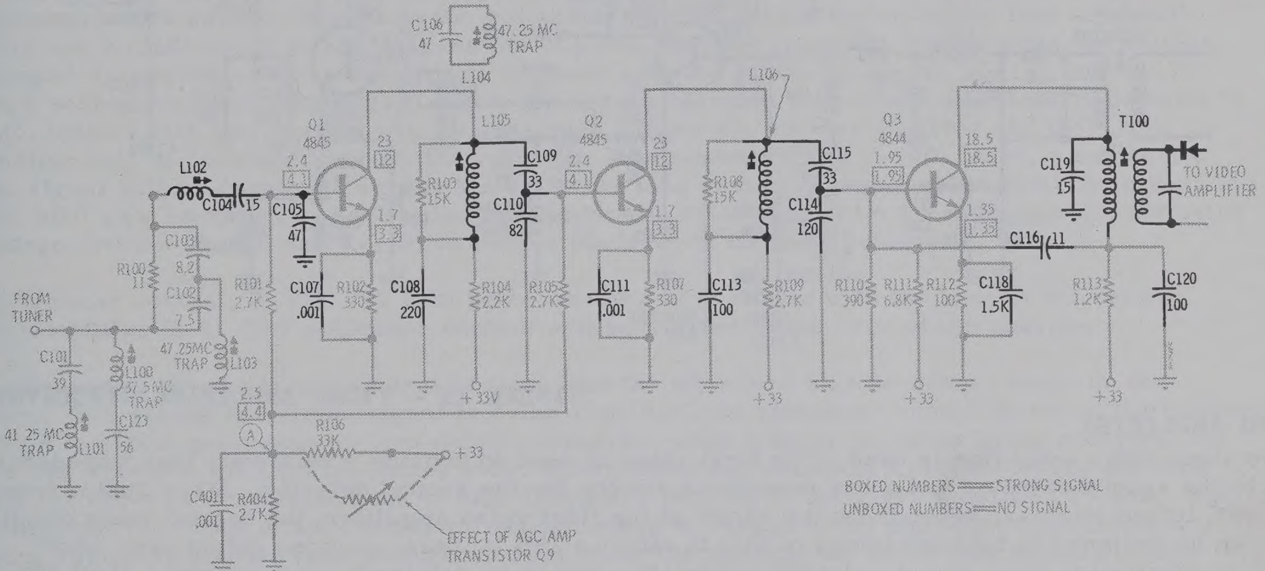
4. If no output is noted at 2nd detector, the video amplifier bias setting and range is checked by shorting base and emitter of 3rd IF transistor and monitoring voltage on the 1st video amplifier base. If the video amplifier bias (and range) is correct, the defect is probably in the video IF. The scope remains on the base of the 1st video amplifier to indicate IF output as the IF is analyzed.

5. If the video amplifier bias (or range) is not correct, the noise gate, video amplifier stage and 2nd detector are analyzed to determine which is causing inability to obtain the correct video bias.

Other service techniques will evolve such as starting out by using signal injection to locate the defective stage or using a RF probe and signal tracing to locate the defective stage. The specific technique will vary with the individual and the equipment on hand. The important consideration is to develop a technique which will indicate the defective stage or stages.

Once the defective stage or stages have been located, they often can be analyzed by merely evaluating the DC voltages on the stage.

Voltage measurements will disclose many circuit defects that have upset the normal currents in these stages. The base and emitter voltages should be carefully checked and compared to the schematic no signal voltages (tuner set for no signal input by rotating between channels and the +2.5 volts bias should remain on the IF AGC buss). The collector voltage may also provide important clues, i.e., +33 volts is indicative of a non-conducting stage. The principal biasing resistors are shown in Figure #23. Other components such as open collector resistors or shorted capacitors may also affect the voltage readings.


C106
47
47.25 MC TRAP
L104
L105
L106
Q1
4845
Q2
4845
Q3
4844
T100
L102
C104
15
C105
47
2.4
4.1
23
12
1.7
3.3
C109
33
C110
82
R103
15K
C115
33
C114
120
R108
15K
1.95
18.5
1.35
C119
15
TO VIDEO AMPLIFIER
C116
11
C103
8.2
C102
7.5
R100
11
R101
2.7K
C107
.001
R102
330
C108
220
R104
2.2K
R105
2.7K
C111
.001
R107
330
C113
100
R109
2.7K
R110
390
R111
6.8K
R112
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C118
1.5K
R113
1.2K
C120
100
FROM TUNER
C101
39
L100
37.5MC TRAP
47.25MC TRAP
L103
41.25 MC TRAP
L101
C123
56
+33V
+33
2.5
4.4
A
R106
33K
C401
.001
R404
2.7K
EFFECT OF AGC AMP TRANSISTOR Q9
BOXED NUMBERS═══STRONG SIGNAL
UNBOXED NUMBERS═══NO SIGNAL

FIGURE 24 - SIGNAL PATH DEFECTS

"In-circuit transistor testing" can easily be applied to the IF transistors. Simply monitor the transistor collector voltage. If it is lower than the supply voltage (+33V), the transistor is conducting. Then, while monitoring the collector voltage, use a small screwdriver or soldering aid to short the base and emitter together. The collector voltage should rise toward the supply voltage indicating that the transistor is capable of being turned off. At the onset of the test, the collector voltage measured can be compared to the specified voltage on the schematic diagram. An excessively high or low reading would be indicative of a malfunction in the stage which should be analyzed. If the collector voltage is normal, proceed with the next step and, if the collector voltage does not rise toward its supply voltage, the stage should be analyzed to determine the cause.

If voltage measurements do not disclose the defect, the next step is to evaluate the components that will affect the AC or RF operation but have little or no effect on bias or DC voltages. These components are shown in Figure #24 and are components that exist in or affect the AC signal path.

Signal injection may prove helpful in locating the offending stage. Use an AM signal generator set at 44Mc modulated with 400 cycles AM. The signal should be applied between base and ground starting at the 3rd IF and working back toward the tuner input. As the generator is moved toward the IF input one stage at a time, less generator output should be required to provide the same output signal on the scope or CRT. CAUTION: Just touch the base element of the transistor taking care not to short it to the collector which could result in excessive current and a damaged transistor.

Locating the defective stage with signal injection reduces the number of signal path components to check.

The coils can generally be checked with an ohmmeter. Since shorted capacitors should be detected during the previous voltage analysis, the procedure now is to check for open capacitors. This is best accomplished by temporarily paralleling the suspected capacitor with one of approximately the same value and an equal or higher voltage rating. The tuner should be turned to a local channel and the effect of bridging in the new capacitor can be noted in the picture. It is important to note that the capacitor being placed in parallel with the suspected one be approximately the same value. For example, C-108 and C-113 are selected to afford some stage degeneration and if a large value capacity is placed across them, the degeneration is removed and the stage may oscillate.

The last area to suspect during IF analysis is alignment. Unless the IF alignment cores are misadjusted, there is little liklihood of the alignment getting far out of adjustment. Even if the cores are misadjusted, the probable effect will be poor performance rather than completely inoperative. Alignment should be performed on an IF system only if it is surely ascertained that there are no defective components causing the problem.

VIDEO AMPLIFIER SYSTEM

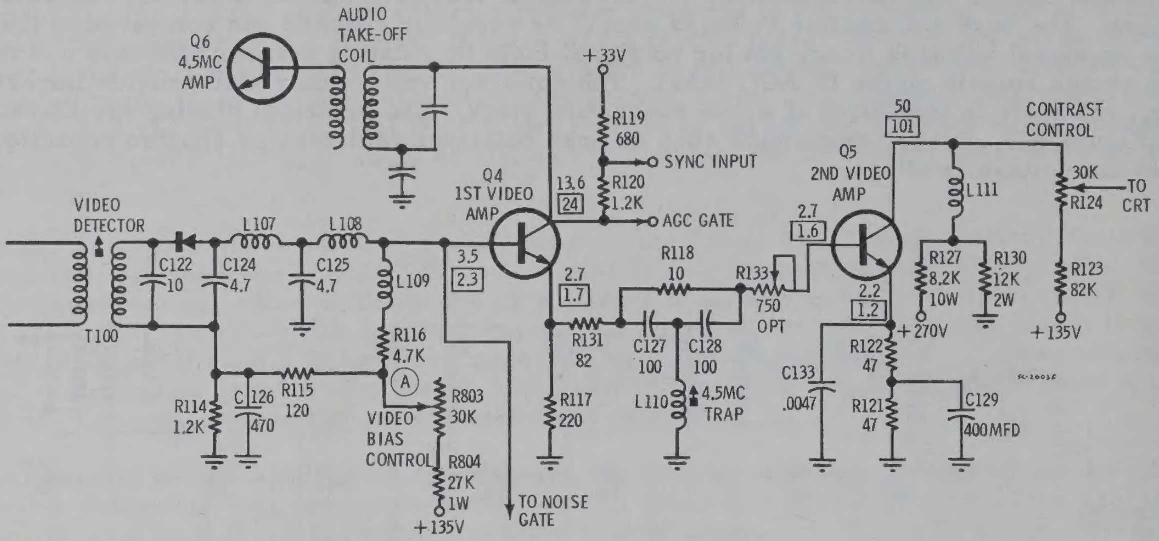

Q6
4.5MC
AMP
AUDIO
TAKE-OFF
COIL
+33V
R119
680
SYNC INPUT
R120
1.2K
AGC GATE
13.6
24
Q4
1ST VIDEO
AMP
VIDEO
DETECTOR
L107
L108
C122
10
C124
4.7
C125
4.7
L109
3.5
2.3
2.7
1.7
T100
R116
4.7K
A
R114
1.2K
C126
470
R115
120
R803
30K
VIDEO
BIAS
CONTROL
R804
27K
1W
+135V
TO NOISE
GATE
R131
82
R118
10
C127
100
C128
100
L110
4.5MC
TRAP
R117
220
R133
750
OPT
2.7
1.6
Q5
2ND VIDEO
AMP
50
101
2.2
1.2
+270V
C133
.0047
R122
47
R121
47
C129
400MFD
L111
R127
8.2K
10W
R130
12K
2W
CONTRAST
CONTROL
30K
R124
TO
CRT
R123
82K
+135V
SC-20036

FIGURE 25 - VIDEO AMPLIFIER CIRCUITRY

VIDEO AMPLIFIER

A two stage video amplifier is used. The first stage is used to provide a relatively high impedance load to the second detector and a low impedance source for the second detector. Since audio, sync and AGC information are taken from the output of the first video amplifier, the second video amplifier can be designed to take advantage of this to affect a 25% increase in video output over what could be obtained if sync, sound and AGC information had to be retained. As a result, a 150V PP video output signal, with clipped sync, is equivalent to a 200V PP video signal without clipped sync pulses.

Forward bias for the 1st video amplifier (Q-4) is provided by R-804, R-803, R-116, R-115 and R-114. R-803 (video bias control) is adjustable and is used to vary the bias of the first video amplifier (Q-4). Since the 2nd video amplifier (Q-5) base circuit is connected back to the emitter of the 1st video, any change in bias setting of R-803 will also change the conduction of Q-5, second video amplifier, as its bias is derived by the current flowing through the emitter resistor (R-117) of the first video amplifier (Q-4). Proper adjustment of the video bias control is to adjust R-803 with a VTVM connected at the collector of Q-5 and set it for a +50 volt reading. At this setting, the base bias volt at Q-4 to ground will be approximately +3.5 volts.

With forward bias applied at Q-4, 1st video amplifier, electron flow is through its emitter resistance, the emitter base junction, L-109 and R-116 (detector load resistor) R-803 and R-804.

The foregoing is applicable when the IF is not active, however, when the IF is amplifying, noise or signal is applied to the second detector diode. The diode conducts on the negative peaks or negative portions of the signal and electrons flow through L-107, L-108, L-109, R-116, R-115 and T-100. The electron flow in R-116 causes a voltage drop due to signal or noise which is in opposition to the bias voltage thus reducing the forward bias on this stage. Since the bias voltage is fed from a bleeder supply from B+, the junction of R-115 and R-803 and R-116 is a relatively stiff source and will cause the bias to change due to signal or noise causing a voltage drop across R-116 which is subtracted from the bias voltage.

Since the 2nd detector output is quite variable with signal strength, noise, etc., it is necessary to eliminate its effect when adjusting the video amplifier bias. This can be done by either of the following methods.

1. Turn off the 3rd IF transistor collector current by shorting its base and emitter together thus cutting it off.

2. Turn the channel selector to an unused channel and apply a +5 volt potential to the IF AGC buss. A battery or 30K potentiometer as previously discussed can be used.

The optimizer is adjusted for minimum resistance (sharp picture - clockwise).

The bias control is then adjusted to provide +50V DC on the collector of the 2nd video amplifier. While the +50 volt on the collector of Q-5 is not exceptionally critical, a lower voltage may tend to cause white limiting and higher positive voltage will reduce the overall system gain. Therefore, if it becomes necessary to adjust the video bias control while viewing the picture, the control should be adjusted clockwise until white limiting is observed on either a local channel or in the noise on an unused channel. The control is then backed off counter-clockwise about 1/4 turn (90°). While this procedure is not recommended, it will offer some form of adjustment in the event it becomes necessary to adjust the video amplifier without a meter.

The 1st video amplifier operates as an emitter follower for video information and as a common emitter for sound, sync and AGC information. Changes in 2nd detector output cause changes in base/emitter voltage which, in turn, cause changes in emitter/collector current. Changes in collector current causes changes in the voltage developed across the collector load resistor (R-119 and R-120) which is 180 degrees out of phase with the incoming signal while the voltage developed across the emitter resistor is in phase with the incoming signal. C-127 and L-110 form a series resonant 4.5Mc trap. Since the series resonant trap offers minimum impedance to 4.5Mc, little 4.5Mc information will be developed across the emitter resistor and the 4.5Mc information will be developed across the collector load resistors and T-300. Also, a composite video signal will be developed across the collector load resistors and coupled directly to the base of the AGC gate transistor. Sync pulse information is also taken from the collector circuit using a voltage divider (R-120 and R-119) to reduce its level to the desired amount.

An optimizer control, R-133, 750 ohm potentiometer is in series with the base of the second video amplifier Q-5. The optimizer control will be located at the rear of the chassis.

The purpose of the optimizer control is to reduce the effects of high frequency noise on the picture. If a strong noise free signal is being received, the optimizer should be set in the "sharp" position to obtain maximum picture detail. However, when a noisy signal is being received, the noise can override the high frequency video information and result in a picture where the high frequency noise is emphasized due to high frequency peaking in the video amplifier stages. The best approach for best picture under all conditions is to reduce video amplifier high frequency peaking for noisy signals (soft picture) and increase the peaking for noise free signals (sharp picture). The optimizer will do this.

As the arm of the optimizer control is turned toward minimum resistance in the circuit, the frequency response is greatest. When the optimizer control arm is turned towards maximum resistance in the circuit, the high frequencies are rolled off.

The emitter resistance of the 2nd video amplifier is in the order of 100 ohms. 47 ohms is by-passed with a 400 uf lytic and provides DC degeneration only while R-122, 47 ohms is by-passed with a .0047 mfd capacitor which results in some capacitive peaking. These are selected along with collector peaking to provide the desired video response.

The collector load, essentially, consists of R-127, R-130 and L-111. R-127 and R-130 form a voltage divider which limits the collector voltage to approximately 170 volts when there is no collector current. When a signal is being received, the collector voltage is approximately 100 volts. The 4819 NPN transistor is a special high voltage type capable of supplying the effective 200V PP of video drive.

The contrast control (R-124) and R-123 also form a portion of the total collector load. The video output voltage is developed across this relatively high impedance load and R-124 is adjustable so the desired amount of video signal can be coupled to the CRT. This arrangement provides a minimum of DC current in the contrast control. Since the normal operating collector voltage is 100 volts, R-123 is returned to the 135 volt buss to provide a minimum DC voltage across the contrast control.

Sync pulse limiting is introduced in the 2nd video amplifier stage. The forward bias voltage is set so that the most negative portions of the video signal (sync pulses) drive the transistor into cut-off. This clips off the sync pulse information as shown in Figure #26. This is entirely permissable since the sync, AGC and sound information have already been sensed and applied to their respective circuits from the output of the first video amplifier and serve no useful purpose on the cathode of the CRT. Since the sync pulse comprises approximately 25% of the video signal, a 150V PP signal without sync pulse information is as effective on the CRT cathode as a 200V PP signal with sync pulse information.

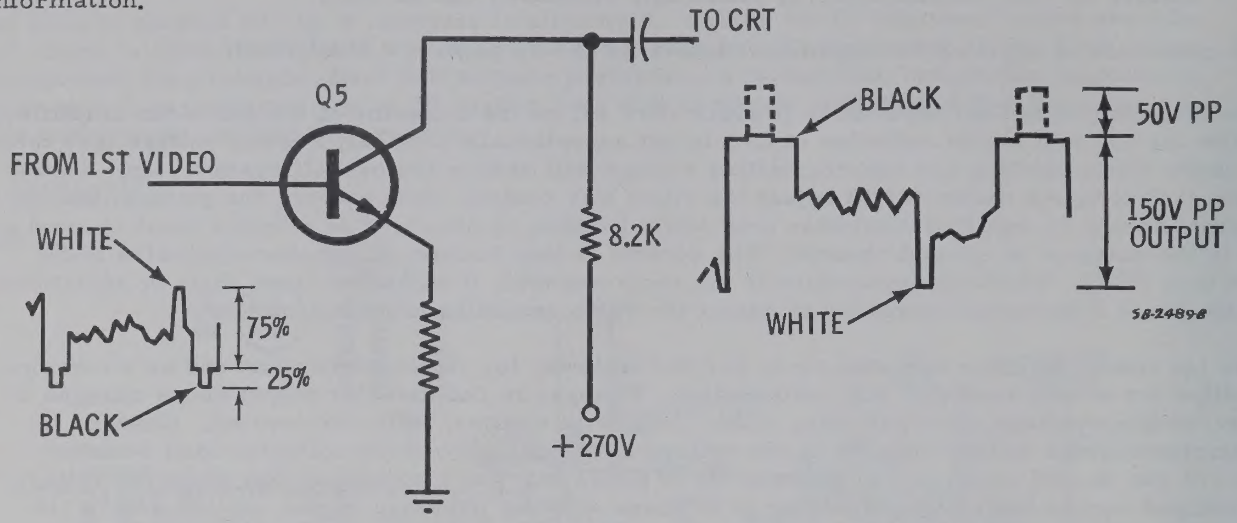


FIGURE 26 - SYNC TIP COMPRESSION IN SECOND VIDEO STAGE

The removal of the sync pulse information allows the maximum video output signal with a given collector voltage.

SERVICING THE VIDEO AMPLIFIER

Since the video circuitry is basically a low frequency amplifier (from detected video signals up to 4.5Mc), it is usually a simple matter to determine if the two stages are functioning. Signal tracing with a scope is the best procedure although the CRT can be used as an indicator. Noise can be injected into the base of the 1st video amplifier (Q-4) by touching with your finger or a metal tool and noting the effect on the CRT screen. If both stages are functioning, noise or flashing will be seen on the CRT screen.

Should this check or a scope check indicate a non-functioning stage, the DC voltages should be checked. Since the two stages are DC coupled, it is quite likely that a defect that would disable a stage will show up in voltage measurements.

Note that the forward bias for the 2nd stage (and hence, its operating voltages) is derived from the emitter voltage of the 1st stage. Therefore, the operating voltages of the 1st video amplifier should be observed and determined to be proper before the 2nd stage voltages are evaluated because a defect in the first stage that affects its operating voltages will affect the voltages on the second stage.

If the current through the 1st stage is incorrect (as indicated by incorrect voltages), the video bias adjustment should be checked. Remove the effect of the video detector output as previously discussed and adjust the bias control for 50 volts on the collector of the second stage.

If the 2nd video amplifier collector voltage can be correctly adjusted for 50 volts, restore the video detector to normal operation and proceed with scope or voltage checks on the stages. However, if the collector voltage on the 2nd stage cannot be adjusted to 50 volts, the base voltage on the 1st video amplifier should be checked (effect of video detector output still removed) to assure that the video bias control can be adjusted to provide +3.5 volts on the 1st video amplifier base. Failure to obtain +3.5 volts or just obtaining +3.5 volts at either end of the control is indicative of a defect in the noise gate circuitry, optimizer or bias controls, 3rd video IF stage or base/emitter junction of the 1st video amplifier transistor. These circuits should be analyzed with the objective of obtaining +3.5 volts on the base of the 1st video amplifier.

After +3.5 volts is obtained with the video bias control on the base of the 1st video amplifier voltage checks in the stages will generally disclose the problem since this is very close to the correct bias voltage for the input stage to provide 50 volts on the collector of the output stage.

Once the voltages on the first stage are established to be correct, the second stage voltages are evaluated. Average voltages, with and without signal, are shown on the schematic.

These checks should disclose the majority of defects since the stages are direct coupled and there are only a few components in the signal path that could disable the stage without also affecting the DC voltages.

For any further check, an oscilloscope should be used. Tune the receiver to a blank channel or a very weak one so that there is no possibility of AGC overload that might be caused by a defect in the first video stage. Starting at the base of the 1st video amplifier, check toward the CRT looking for a loss of noise or picture information.

Care should be used particularly in the second stage to avoid shorting the collector to either of the other elements. The relatively high collector potential could destroy the transistor if it is accidently shorted to the other elements.

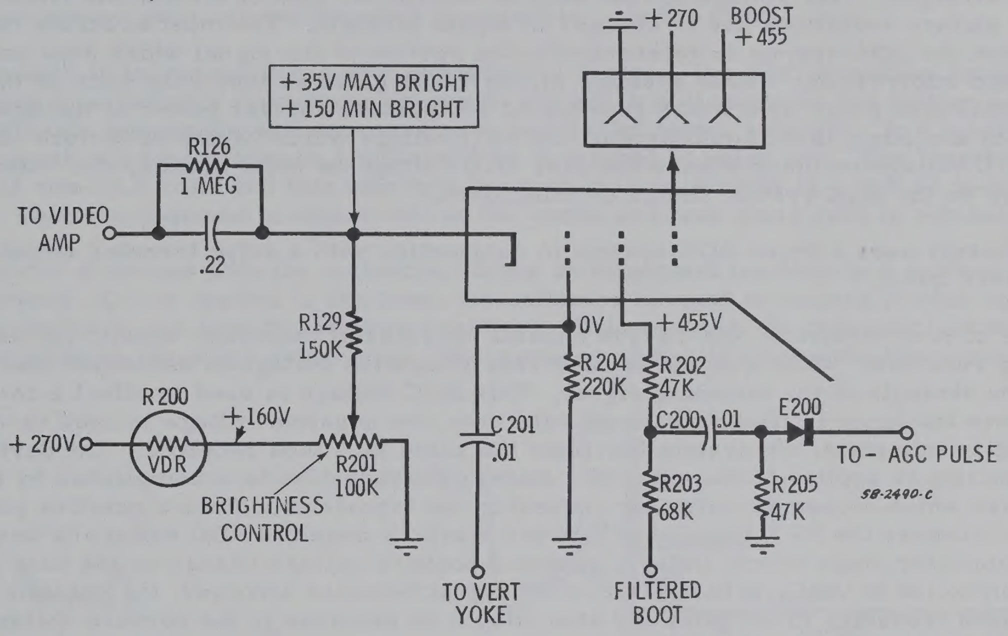


FIGURE 27 - CRT CIRCUITRY

PICTURE TUBE CIRCUITRY

Since basically the same CRT is used in both tube and transistorized receivers, it follows that the CRT circuitry will be the same for either type receiver.

The TS-594 CRT circuitry is shown in Figure #27. Automatic vertical and horizontal retrace blanking is applied to the CRT G-1 and G-2 elements. The brightness control allows an adjustable amount of positive voltage (approximately +35 volts at maximum brightness and +150 volts at minimum brightness) to the CRT cathode. This sets the bias or brightness on the CRT. A voltage dependent resistor is connected in series with the brightness control to prevent a "lingering spot" on the screen after the set is turned off. A voltage dependent resistor (VDR) changes its resistance as a function of the voltage across it. In this case, the resistance increases as the voltage across it decreases. When the set is turned off, the supply voltage starts its rapid decay to zero and since this voltage is across the VDR and brightness control, the VDR resistance increases which causes a smaller positive voltage to be developed across the brightness control than would be the case if the VDR resistance did not change. The result is a less positive voltage on the CRT cathode (same as less negative voltage on the CRT grid) and the CRT conducts heavily which discharges the high voltage capacity and prevents a lingering spot.

Automatic vertical retrace blanking is accomplished in the CRT G-1 circuitry. A pulse from the vertical yoke is coupled to this grid by capacitor C-201. During vertical retrace, a high amplitude negative going pulse is present turning the CRT off. The R-C time constant of C-201 and R-204 is chosen so that the positive going long duration voltage, present during vertical trace, will not appear on the grid and cause a shading effect on the screen. Only the short duration negative pulse that occurs during retrace will appear at this point.

Horizontal retrace blanking is accomplished on the second CRT grid. Positive voltage for this grid is supplied by the filtered boost through R-203 and R-202. A negative going pulse from the horizontal output transformer is capacitively coupled to the grid by C-200. The negative pulse is present during horizontal retrace which is the time that blanking is desired. This pulse has a tendency to ring rather than return back to some given value. Diode E-200 is connected in series to prevent these positive excursions from turning the CRT on. During the time the pulse is positive, the diode appears as an open circuit. During the time the pulse is negative, the diode is forward biased and feeds the pulse to the grid turning the tube off.

Focus voltage is supplied in the usual manner. Three focus potentials are available, filtered boot, B+ 270V and ground. The plug is simply connected to the potential that provides the best overall focus.

AUTOMATIC GAIN CONTROL

The purpose of the AGC system is to develop a DC voltage in the receiver that has a direct relationship to signal strength. This voltage is then used to control the gain of the RF and video IF stages so as to limit picture variations due to changes in signal strength. The most accurate relationship is obtained when the AGC system is referenced to the portion of the signal which does not vary as a function of video information. These systems are keyed or gated so they reference on the signal during horizontal sync pulse time which represents 100 percent carrier power of the input signal. To reference at any other time, could produce an AGC voltage which varied as picture content varied i. e., more AGC voltage on black scenes and less AGC voltage on white scenes, etc. Also, the effects of noise on the AGC system should be minimized.

The TS-594 chassis uses a keyed AGC system in conjunction with a noise inverter circuit (which will be discussed later).

As in the case of tube receivers, the TS-594 chassis operates at maximum sensitivity when no signal is being received. When a signal is received, a negative voltage is developed that is proportional to the strength of the incoming signal. This AGC voltage is used to affect a receiver gain reduction. Since the tuner is the conventional tube type, the negative voltage is used to control tuner gain. Up to this point, the system functions the same as a tube receiver. The deviation occurs when gain reduction is applied to the video IF. Here, gain reduction is accomplished by increasing the forward bias which increases collector current in the transistor. Since a positive going voltage is required to increase the NPN transistor forward bias, the negative AGC voltage is used to control an AGC amplifier stage which, in turn, affects a positive voltage change on the base of the IF transistors controlled by AGC. When an incoming signal becomes stronger, the negative AGC voltage increases (reducing tuner gain) and also affects an increase in the positive voltage on the base of the IF transistors (reducing IF gain).

The basic principle involved in using an increase in forward bias to affect gain reduction is shown in Figure #28.

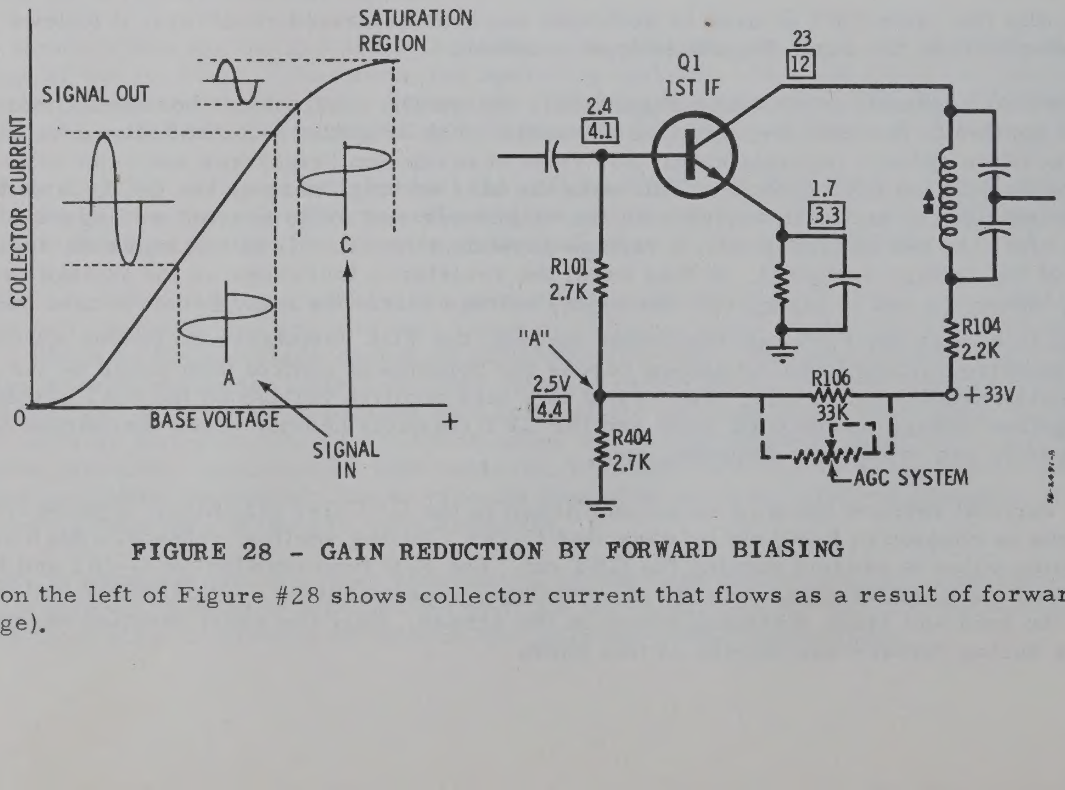


FIGURE 28 - GAIN REDUCTION BY FORWARD BIASING

The curve on the left of Figure #28 shows collector current that flows as a result of forward bias (base voltage).

The voltage marked "A" signal represents the maximum gain condition. To either increase or decrease the base voltage (forward bias) that the signal rides on will reduce the stage gain as compared to the maximum gain base voltage (signal A). Whether forward bias is reduced (reverse AGC) or increased (forward AGC) is a function of several design considerations. For example, if MADT (Micro Alloy Diffused Base Transistor) transistors are used, forward AGC affords the best gain control since the gain of a MADT transistor decreases as collector/emitter voltage is reduced. If a Mesa transistor were used, reverse AGC affords the best gain control because, although collector/emitter voltage has an effect of gain, this effect is not nearly as great as with a MADT transistor and probably would not provide enough dynamic range. Other considerations are also involved. Forward AGC increases collector current which reduces input and output impedance and increases output capacitance while reverse AGC has the opposite effect. Forward AGC has higher base/emitter bias voltage which affords less tendency for overload.

The diagram of an IF stage in Figure #28 shows how forward AGC is used in the TS-594 chassis. R-106 and R-404 form a voltage divider from +33 volts and causes +2.5 volt to be developed at point A (IF AGC test point) which is the forward bias source for the IF transistors. Under these conditions, transistor Q-1 has .7 volt forward bias (2.4 volt on base and 1.7 volt on emitter) which will provide maximum gain and corresponds to signal "A" on the curve.

As signal strength is increased and a gain reduction is desired, the AGC amplifier transistor has the same effect as a variable impedance across R-106 which will increase the voltage at test point "A". This variable impedance will decrease as a function of signal strength. In a moderately strong (snow free) signal, approximately +4.4 volts will be developed at point "A". The transistor forward bias source is now +4.4 volts and this affects a forward bias of .8 volts (4.1 volt on base and 3.3 volt on emitter). This corresponds to signal "C" on the curve and less stage gain is obtained.

R-104, a resistor in series with the collector, forms an important function in a system using forward AGC. As forward AGC is applied to the base, the collector current increases producing a larger voltage drop across R-104 (and the emitter resistor). This reduces the collector/emitter voltage which further reduces the stage gain, hence, the presence of R-104 makes the transistor easier to saturate.

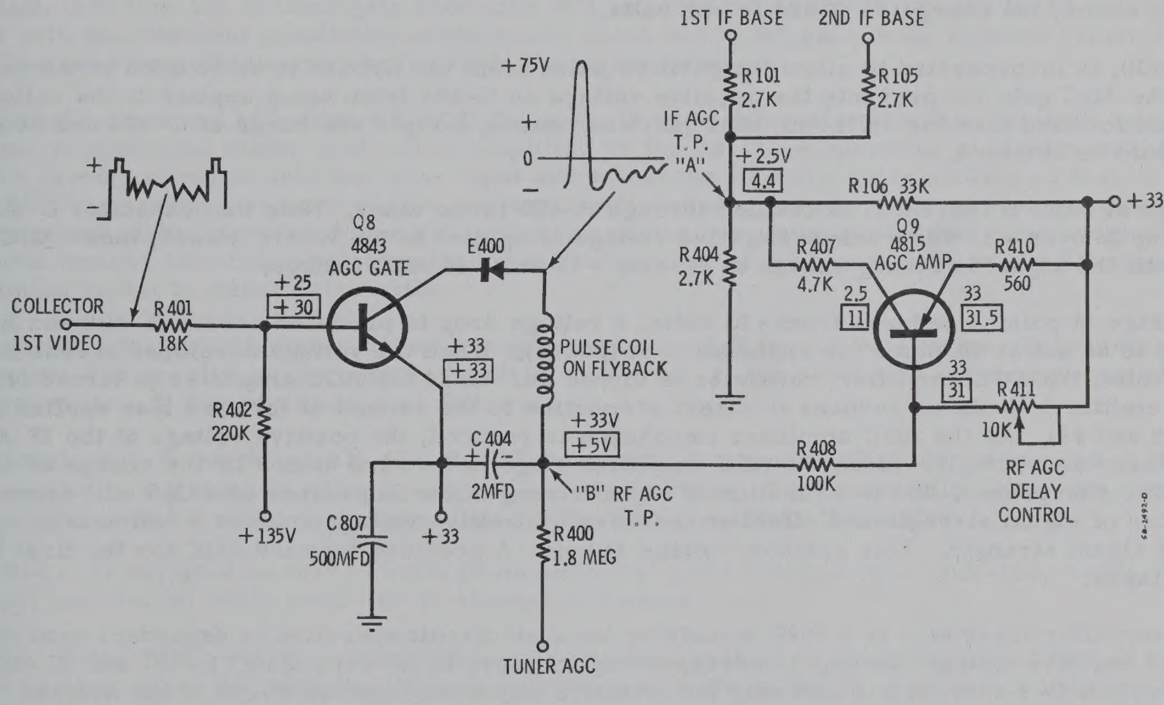


FIGURE 29 - AGC GATE & AMPLIFIER CIRCUITRY

The circuitry for producing the voltages necessary to provide gain changes is shown in Figure #29.

The function of Q-8 (AGC gate) is to develop a negative voltage that is proportional to signal strength. This voltage (RF AGC test point "B") is used to reduce the gain of the conventional tube type tuner and also to provide forward bias on Q-9 (PNP AGC amplifier) in proportion to the strength of the incoming signal. The impedance of Q-9 varies as a function of forward bias and affects a change in the IF AGC voltage at IF AGC (test point "A"). The collector to emitter impedance of Q-9 decreases as a function of signal strength and affects an increase in positive voltage at test point "A". This increases forward bias on the IF stages producing a gain reduction.

R-411 is an adjustable potentiometer used to set the RF AGC delay and its purpose and adjustment are discussed later. It can be considered a fixed resistance with respect to understanding circuit operation.

The AGC gate transistor (Q-8) is a gated stage because its collector voltage is obtained from a positive pulse from a winding on the horizontal output transformer. The collector pulse occurs during horizontal retrace which is when the horizontal sync pulse is present on the composite video signal applied to the base.

Q-8 is reverse biased under no signal conditions since the emitter is at +33 volts and the base at +25 volts. The voltage (and signal) at the collector of the 1st video amplifier is coupled to the base of the AGC gate. When a signal is received, the negative going sync pulse at the input of the 1st video amplifier reduces its collector current so its collector voltage rises. Since the sync pulse does not cut the stage off, the collector voltage does not quite reach +33 volts. Hence, under this condition, the voltage on the collector of the 1st video amplifier could not provide forward bias for the AGC gate amplifier. In fact, if the collector reached +33 volts due to being cut off by the negative sync pulse, it would still only provide zero bias between base and emitter on the AGC gate.

R-402 is connected from +135 volts to the base of the AGC gate to raise the level of the DC voltage to where the variations in signal voltage from the 1st video amplifier will provide forward bias.

When signal is being received, the 1st video amplifier collector voltage will follow the signal and be most positive during sync pulse time. This positive voltage provides forward bias for the AGC gate stage. Since the stage is gated, collector voltage to provide current flow occurs at the same time as the signal sync pulse time and current flows in direct proportion to the magnitude of the input signal sync pulse. This current flow charges up C-404 as shown in Figure #29. The magnitude of the negative charge at point B (RF AGC) will be in direct proportion to the magnitude of the input sync pulse.

The negative charge at point "B" subtracts from the +33 volts supplied through R-411 and R-408. If the charge becomes higher (and it will on strong signals), the voltage at point B will become negative. In the case shown, the charge on C-404 is -28 volts.

Diode, E-400, is incorporated to allow the positive pulse from the flyback to be coupled to the collector of the AGC gate but prevents the negative voltage on C-404 from being applied to the collector which would forward bias the collector/base junction causing a rapid discharge of C-404 and no AGC voltage would be retained.

The voltage at point B (RF AGC) is coupled through R-400 to the tuner. Note that capacitor C-404 has to charge up to over - 33 volts before negative voltage is applied to the tuner. Hence, tuner AGC is delayed until the signal is strong enough to develop - 33 volts of AGC voltage.

As the voltage at point B reduces from +33 volts, a voltage drop is produced across R-408 and R-411 (estimated to be set at 4K ohms for explanation purposes). When the voltage developed across R-411 equals .5 volts, the AGC amplifier transistor is turned on. When the AGC amplifier is turned on, its collector/emitter impedance reduces in direct proportion to the amount of forward bias applied (see Figures #8 and #9). As the AGC amplifier impedance is reduced, the positive voltage at the IF AGC buss increases accordingly. Since the AGC amplifier stage is forward biased by the charge on C-404 and since the charge on C-404 is a function of signal strength, the impedance of a Q-9 will decrease as a function of signal strength and affect an increase in positive voltage at point A which is a function of signal strength. This positive voltage at point A provides forward AGC for the first two video IF stages.

The AGC amplifier transistor is a PNP transistor because circuit operation is dependent upon an increase in negative voltage causing a corresponding increase in forward bias. R-407 and R-410 are selected to limit Q-9 current and increase the effective impedance across R-106 to the desired value. During no signal conditions, the voltage at point B is +33 volts so the emitter and base of Q-9 are at the same potential causing Q-9 to be turned off and the voltage at point A is the result of the voltage divider action of R-106 and R-404. When signal is received, C-404 charges and reduces the voltage at point B which provides a voltage drop across R-411 affecting a forward bias for Q-9 and the AGC action is started.

The value of R-411 determines the AGC voltage delay. For example, if R-411 were zero ohms, there would be no forward bias for Q-9 and the only stage obtaining AGC would be the tuner. Conversely, if R-411 were increased in value more of the voltage difference between point B and +33 volts would appear across R-411 and the IF AGC would turn on sooner and stronger so little AGC action would be required in the tuner.

RF AGC DELAY CONTROL

Adjustable RF AGC delay is incorporated to provide the best possible signal to noise ratio and freedom from overload. The purpose of delaying the RF AGC (which reduces tuner gain) is to operate the tuner RF stage at high gain until its signal output is greater than the mixer noise. This provides an excellent signal to mixer noise ratio and noise from the mixer is not seen in the picture. After this condition is met, it becomes necessary to apply RF AGC to the tuner to prevent strong signals from overloading the mixer stage.

As soon as the signal at the second detector reaches a value of approximately 2 volts PP, some AGC voltage is made. This voltage is proportional to the signal strength and is used initially to reduce the gain of the IF stages. As the input signal further increases, more AGC voltage is developed and, in the TS-594 chassis, when the AGC voltage reaches a value near - 33 volts, the tuner gain starts to be reduced by the AGC voltage. At values of AGC voltage up to - 33 volts, the IF gain only is being reduced.

The AGC system develops as much voltage as required to keep the 2nd detector output signal at a level of approximately 2 volts PP. It would be possible to use the AGC voltage to control the IF gain only and maintain the constant 2 volt PP output at the 2nd detector but then strong signals would overload the mixer and possibly the RF stage. Also, it would be possible to use the AGC voltage to control tuner gain only and maintain the constant 2V PP at the 2nd detector but then, on moderate strength signals, the tuner gain would be reduced and the signal would not be amplified enough to override mixer noise so the picture would have a busy background due to the mixer noise.

As previously mentioned, the RF AGC in the TS-594, is delayed until the AGC voltage developed reaches a value of - 33 volts while IF AGC is applied as soon as the input signal reaches a value of approximately 2 volt PP. The function of the RF AGC delay control is to set the effect of the AGC voltage on the IF so that at the instant the tuner input signal is large enough to overcome the mixer noise, AGC voltage is applied to the tuner. If the effect of the AGC voltage on the IF is too great, more than the desired gain reduction will be provided by the IF and the tuner will turn off later with the attendent possibility of overload on strong signals. If the effect of the AGC voltage on the IF is too small, less than the desired gain reduction will be provided by the IF and the tuner will turn off sooner with the attendent possibility of the mixer noise due to RF gain being reduced before the signal has been amplified enough to override the mixer noise.

A sophisticated method of setting RF AGC delay would be to determine the value of input signal sufficient to overcome mixer noise when amplified by the RF stage operating at maximum gain. Then feed this amount of signal into the tuner input and adjust the RF AGC delay control so that, in the case of the TS-594 chassis, -33 volts of AGC voltage is developed. Then, any signal stronger than this predetermined signal causes a tuner gain reduction giving maximum protection from overload. Also, any signal weaker than this predetermined signal is handled at maximum gain by the RF stage giving a maximum signal to mixer noise ratio.

R-411, a 10K ohm potentiometer, is used to provide control of the RF AGC delay. It is unlikely that this control will require adjustment in the field. However, in the event that it becomes misadjusted for some reason, it can be adjusted as follows.

1. Short point B (junction of R-408, R-400 and C-404) to ground. This places one end of R-408 at zero volts and the other end through R-411 at +33 volts. The current flow provides a voltage drop across R-411 which is forward bias for the AGC amplifier transistor.

2. R-411 is adjusted so that +5 volts is measured at point "A" (junction of R-404, R-106, R-407, R-101 and R-105) while point "B" is shorted to ground.

This sets up the AGC system so that when - 33 volts AGC voltage is being developed (which brings point B to zero volts) the AGC amplifier is providing +5 volts on the IF AGC buss. This is a close approximation to the system requirements under these conditions based on curves plotted using the more sophisticated method previously mentioned.

In an emergency, the RF AGC delay control could be adjusted while viewing a picture.

Tune in the strongest channel available. Adjust the RF AGC delay control and note its effect on the picture. In one area of the control adjustment, the picture will have noise or a busy background and as the control is rotated, the noise or busy background will disappear. Further rotation of the control will cause overload. The first symptoms of overload will be a loss of interlace. The control is adjusted mid-point between the setting at which the busy background disappears and the setting where converter overload starts (loss of interlace).

SERVICING THE AGC CIRCUITRY

Troubles in a gated AGC system usually show up in one of two ways. Either the system is incapable of making the necessary AGC voltage or it makes too much. The first is usually more common. With this condition, the receiver will operate normally if the input signal is reduced to a low enough value where no gain reduction is required. Any increase in signal will cause the picture to bend or disappear into a blank snow free raster.

With the second condition, the excessive AGC voltage will turn off the IF and/or tuner and it will be impossible to receive a signal.

Trouble shooting an AGC system may, at first glance, appear to be difficult since it is sometimes difficult to determine which problem is the cause and which is the effect.

For instance, distortion (bending or overload) might be caused by a defect in the IF amplifier itself or because it lacks sufficient AGC voltage. To determine which circuit actually contains a defect, the following procedure can be followed.

1. Temporarily remove the effect of the noise gate transistor from the circuit. This can be accomplished by cutting the wire test loop provided in the emitter circuit. If the receiver becomes normal, the noise gate transistor and circuitry should be checked. If the defect still exists, the test loop can be left open while other portions of the receiver are analyzed and soldered closed after the receiver has been repaired.

2. Temporarily remove the effect of the AGC amplifier transistor from the circuit by cutting the wire test loop provided on its 4.7K ohm (R-407) collector resistor. Turn the channel selector between channels. Snow should be observed on the screen (a very snowy picture can also be used for this test).

   If this cannot be accomplished, the defect is likely in the picture channel (tuner, IF or video amplifier stages). These should be checked as outlined in their respective sections.

As pointed out in the section on servicing the transistor IF, the easiest method in the long run is to apply a form of external bias to the IF AGC buss. This positive voltage is varied from +2.5 volts to +5.5 volts and can be in the form of an external battery or 50K ohm potentiometer. If the picture is correct as the bias is adjusted thru this range, the defect is probably in the AGC system. Refer to the section on servicing the transistorized video IF for details on applying external bias.

If the defect has been determined to be in the AGC system, the AGC system capability to make control voltages should be evaluated. Turn off the 1st video transistor by shorting base and emitter together. This will allow the collector to rise to +33V. This will represent the strongest signal the set will ever receive since the sync pulses (negative going) on the base almost turn off the transistor and allow the collector to instantaneously rise to B+ 33. In other words, the AGC system will be turned "full on". Referring to Figure #30, the voltage at point "B" should be negative 20 volts or higher.

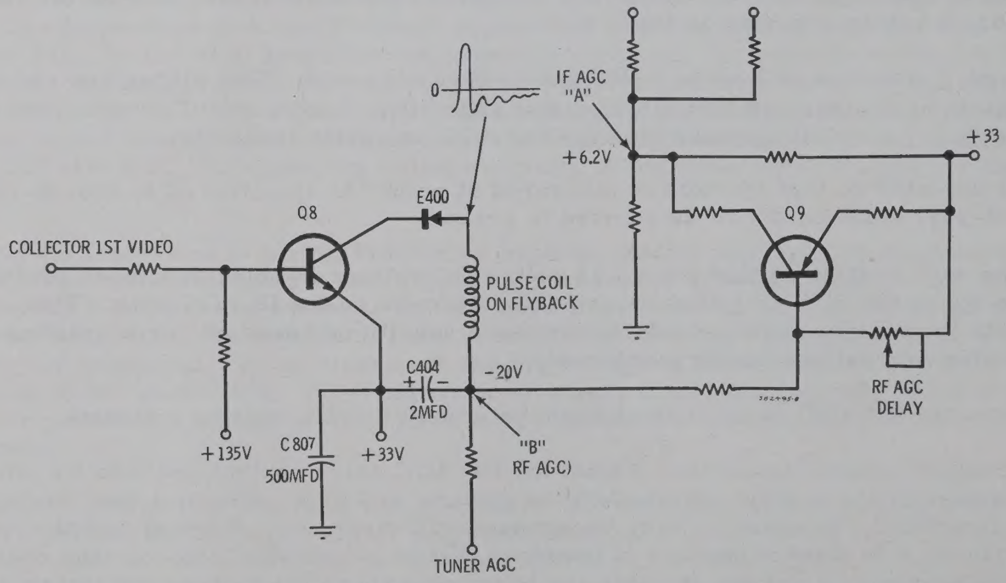


FIGURE 30 - AGC VOLTAGES WITH 1ST VIDEO TRANSISTOR TURNED OFF

Inability to produce this voltage would indicate a defective transistor Q-8, defective diode, loss of pulse from the coil or defect in any of the associated resistors and capacitors.

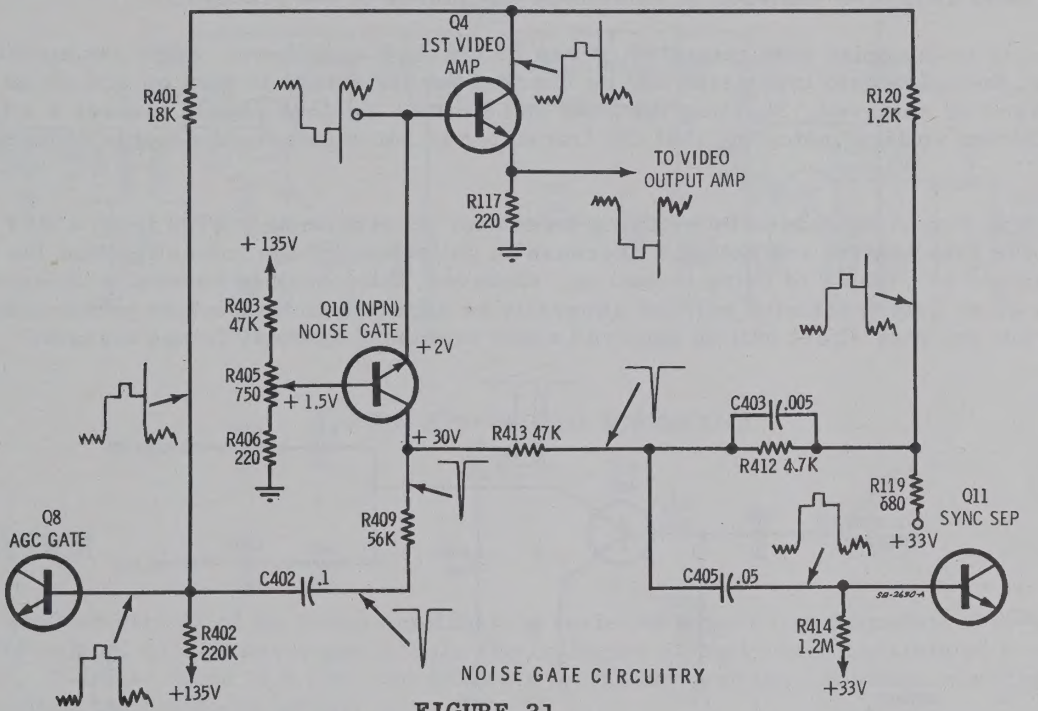
If -20 volts is produced at Point "B", it is likely that the AGC gate stage is functioning properly. The AGC amplifier should then be checked. With -20V present at Point "B", transistor Q-9 should be turned on sufficiently to produce +6.2V at Point "A". Inability to accomplish this would likely be caused by a defective Q-9 or any of the resistors shown in the AGC amplifier stage in Figure #30.

If none of the above checks disclose the defect, the video signal can be distorted so that the AGC system fails to operate properly. The video detector diode should be substituted. Using an oscilloscope to observe the waveforms going into the AGC system may also be helpful.

NOISE GATE

Because the AGC system samples the strength of the signal only during horizontal sync time, it is immune to noise interference at all other times. A properly adjusted noise gate circuit will help to make the AGC system immune to noise even during horizontal sync time and will help to remove noise signals from the sync separator stage as well.

The circuitry is shown in Figure #31.



NOISE GATE CIRCUITRY

FIGURE 31

Basically, the noise gate (sometimes called a noise inverter) is a transistor stage that is reverse biased so that normal amplitude video signals do not turn it on. When a noise pulse is received that is larger in amplitude than the video signal, the stage conducts and makes an amplified negative going pulse from the noise. This negative pulse is fed to both the sync separator and the AGC stage and cancels the noise burst.

The emitter of Q-10 is connected directly to the base of the first video amplifier stage and has the same potential or approximately +2V when a signal is being received. The base of Q-10 is connected to an adjustable voltage source which is adjusted to provide approximately +1.5V to the base for normal operation. With these conditions, the stage is reverse biased or cut-off. The video signal from the first video stage is negative going which is the direction that will turn the noise gate stage on if the amplitude becomes large enough.

The noise gate control is adjusted so that the stage is reverse biased and the negative going horizontal sync pulses fed to the emitter do not have sufficient amplitude to turn the stage on. Any noise that is present on the sync pulse that is larger in amplitude than the pulse will drive the transistor on. The noise pulse only will be amplified in the collector circuit. The circuit configuration is common base hence no phase inversion occurs and the noise pulse in the collector circuit is negative going also.

The negative noise pulse is coupled thru C-402, .1 mfd to the base of the AGC gate where it cancels the positive noise pulse in the signal from the 1st video amplifier collector.

A reduced value of the negative noise pulse is developed at the junction of R-413 and R-412 which cancels the positive noise pulse in the signal from the 1st video amplifier collector circuit.

Cancelling out noise pulses provides a measure of noise immunity for the AGC and sync separator stages.

Adjustment of this circuit is very simple. The receiver should be correctly tuned to the strongest channel to be received. Starting with the noise gate control maximum counter-clockwise (off), slowly rotate it clockwise until the picture starts to bend or fall out of sync. Then back up until the picture is stable.

Malfunctions in this circuit can cause picture tearing or bending that can easily be confused with AGC or sync trouble. Also a defect in the noise gate circuit can prevent proper setting of 1st video amplifier bias.

To eliminate the noise gate transistor as the source of a problem, it can be removed from the circuit by cutting the wire test loop in its emitter circuit. If the problem clears up, the noise gate circuitry (and adjustment) should be checked. If the problem persists after the test loop has been cut, other circuits should be analyzed to determine the source of the problem.

If the problem is in the noise gate circuitry, it can be checked as follows. After reconnecting the wire test loop, the noise gate transistor can be checked for its ability to turn on and off as forward bias is increased or removed. Shorting the base and emitter together should provide a slight increase in collector voltage indicating that the transistor is not shorted and capable of being turned off.

The forward bias can be increased by bridging a resistor (approximately 27K) from +135V to the arm of the noise gate control and noting a decrease in collector voltage indicating that the transistor is not open and is capable of being turned on. However, this check is generally unnecessary since an open noise gate transistor will not generally be apparent in the picture performance on most signals and the only effect will be impared noise immunity on noisy fringe signals.

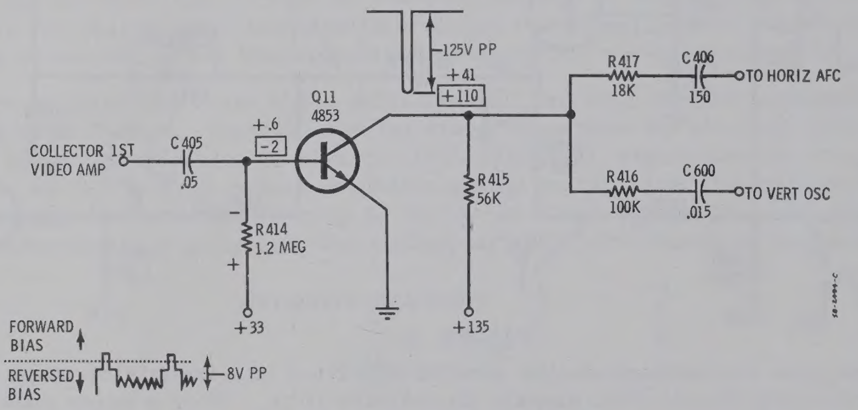


FIGURE 32 - SYNC SEPARATOR

SYNC SEPARATOR

The sync separator's function is to receive the complete video signal and separate out the sync pulses and discard all of the other information. For this application, a transistor operates very similar to a tube type sync separator. The circuit is shown in Figure #32.

Two sets of DC voltages are shown. The ones in boxes are with signal and the others are with the channel selector half way between channels (no signal). These voltages are not exact since they can be affected by signal strength and video bias adjustment. They do, however, represent typical operation.

For no signal operation, R-414 forward biases the stage so that there is considerable collector current. This is evidenced by the 94V drop across the collector load.

When a positive going signal is received from the first video amplifier, the base is driven positive (by the composite video signal) as compared to the emitter.

This causes electrons to flow from the emitter to the base through R-414 causing the base to become negative. This is very similar to drawing grid current in a tube.

The stage now has considerable reverse bias. The positive sync tips are of sufficient amplitude to overcome the reverse bias and turn the transistor on for the duration of the pulse. During the conduction time, the base emitter current restores the negative voltage stored in C-405.

During scan time (time between sync pulses), the stage is reverse biased and does not draw collector current so the video information is not reproduced in the collector. The higher amplitude sync information will drive the transistor "on" and the sync information will be reproduced in the collector reversed 180°.

These pulses are adjusted for the proper amplitude and waveform by R-417, R-416 and fed to the horizontal and vertical sweep systems.

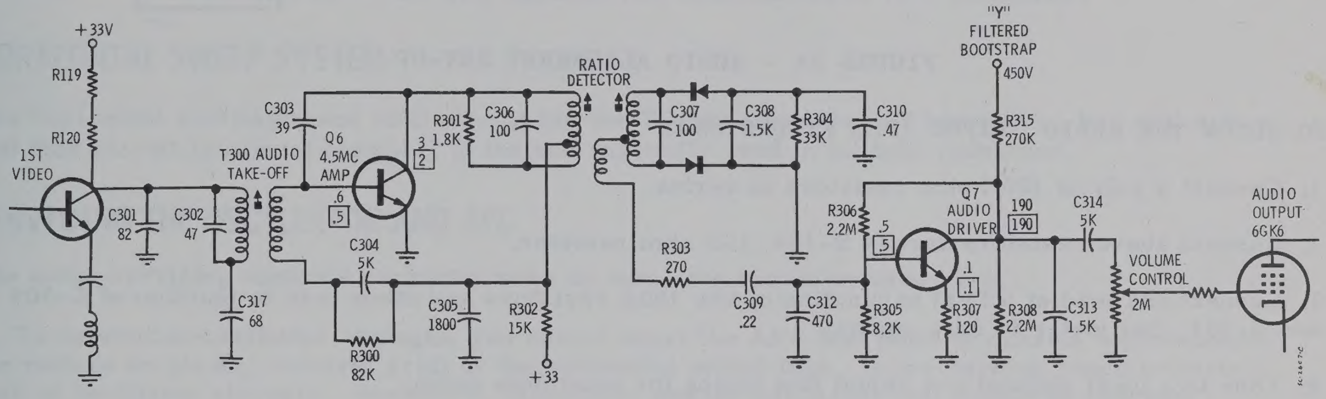

+33V
R119
R120
1ST VIDEO
C301 82
C302 47
C317 68
T300 AUDIO TAKE-OFF
C303 39
Q6 4.5MC AMP
.6
.5
3
2
C304 5K
R300 82K
C305 1800
R301 1.8K
C306 100
R302 15K
+33
RATIO DETECTOR
C307 100
C308 1.5K
R304 33K
C310 .47
R303 270
C309 .22
C312 470
"Y" FILTERED BOOTSTRAP
450V
R315 270K
R306 2.2M
.5
.5
Q7 AUDIO DRIVER
190
190
.1
.1
R305 8.2K
R307 120
R308 2.2M
C313 1.5K
C314 5K
VOLUME CONTROL
2M
AUDIO OUTPUT 6GK6

FIGURE 33 - AUDIO SCHEMATIC

AUDIO SYSTEM

Since the emitter circuit of the video amplifier is series resonant (low impedance) to 4.5Mc, most of the 4.5Mc signal will be developed across the collector circuit which consists of R-120, R-119 and T-300. T-300 is tuned to 4.5Mc and affects a match between the 1st video amplifier collector and the input of the 4.5Mc amplifier.

The 4.5Mc amplifier stage is designed to oscillate at a frequency very close to 4.5Mc. The 4.5Mc input signal controls the frequency of its oscillation. The advantage of having the stage oscillate becomes apparent on weak signals because audio signals to weak to be heard above the noise level are strong enough to control the oscillations and result in a usable FM output signal.

Feed-back to provide oscillation is provided by C-304 and R-300. C-305 does not afford complete by-passing of collector resistor R-302 and the output signal developed across C-305 is coupled back to the input.

Forward bias for the base of Q-6 is obtained through R-302 and R-300. The forward bias voltage is approximately .6 volts and this starts collector current to flow. When collector current flows, the stage will oscillate. This will cause the stage to operate Class C and the base voltage will drop to a lower value which will be a function of the strength of oscillation and in the case of strong signals, a function of signal strength. This is due to C-304 charging up on positive peaks of the feedback signal or on the input signal depending on the existing mode of operation.

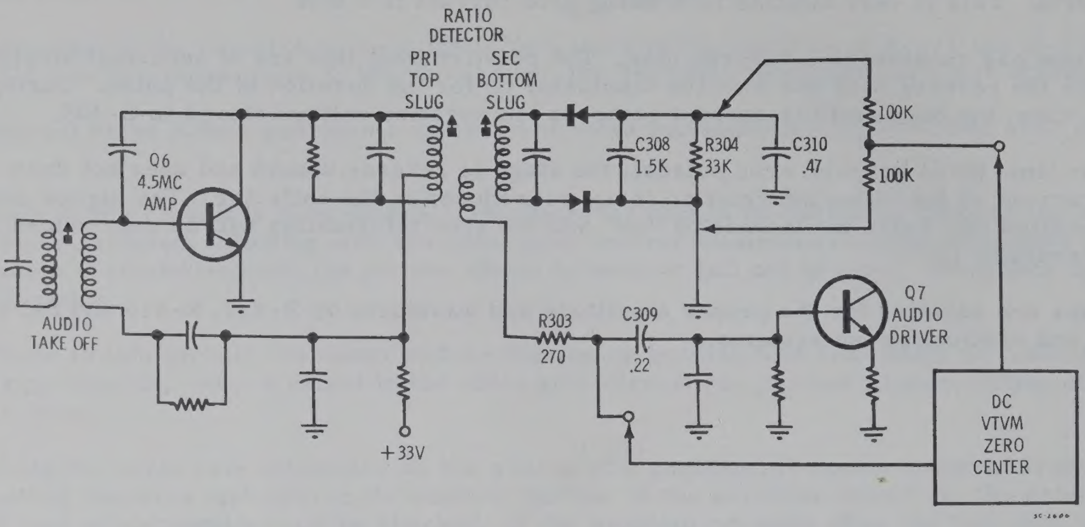


FIGURE 34 - AUDIO ALIGNMENT SET-UP

TO ALIGN THE AUDIO SYSTEM (SEE FIGURE #34)

1. Connect a pair of 100K ohm resistors in series.

2. Connect above resistors across R-304, 33K ohm resistor.

3. Connect one lead of VTVM to junction of two 100K resistors and other lead to junction of C-309 and R-303. Set meter to zero center.

4. Tune in a local channel and adjust fine tuning for maximum audio.

5. Misadjust secondary (bottom slug) of ratio detector slightly and note direction of meter movement. Leave secondary slug in this position.

6. Adjust primary of ratio detector (top slug) for maximum output. The meter will go in the same direction from zero as noted in Step #5 as coil is tuned for maximum output.

7. Adjust audio take-off coil (T-300) for maximum output using same technique as in Step #6.

8. Adjust ratio detector secondary for zero volts.

9. Reduce signal input to level where considerable noise is present with audio. Signal input can be reduced by tuning into smear and/or reducing signal input to tuner. Adjust audio take-off coil for minimum noise and best audio as judged by listening to output.

AUDIO DRIVER

The audio driver, Q-7, is used to bring the recovered audio to a sufficient level to drive the 6GK6 audio output stage. To obtain forward bias, R-306 and R-305 form a voltage divider from the collector voltage. This method of obtaining forward bias increases stability because as transistor collector current increases, the collector voltage is reduced which reduces forward bias affecting a reduction in collector current. Normal forward bias is in the order of +.55 volts. Note that the collector voltage is supplied from filtered bootstrap through a voltage divider of R-315 and R-308. This affords a delay in audio output until the high voltage has been developed and the set has a raster. This prevents the audio from coming on and making noise before the AGC (operated by high voltage) can control the signal.

Since the audio driver is operated by bootstrap voltage, defects that affect high voltage (defective damper tube for example) will affect audio and when confronted with a no raster or sound complaint, restoring the raster will generally restore the audio.

Q-7 has a high collector/base breakdown voltage (over 300 volts) so it is important that any transistors substituted in this application also have a high breakdown voltage.

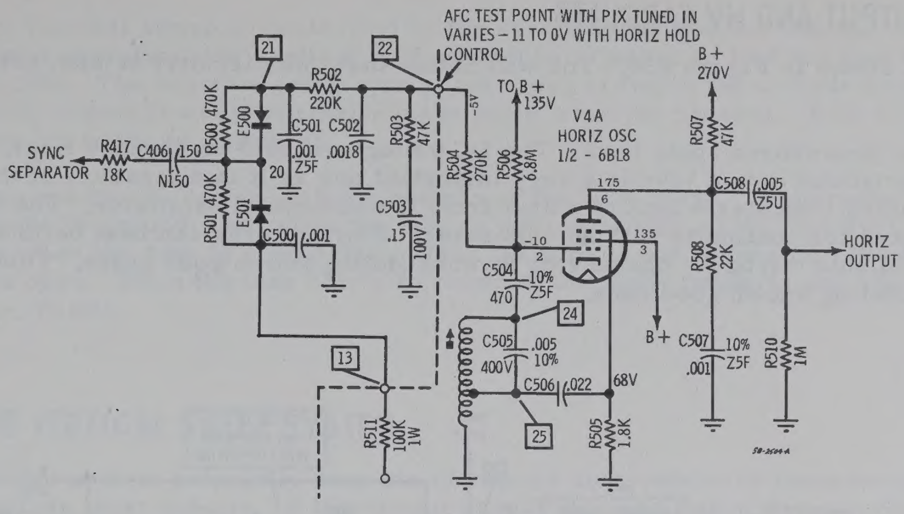

AFC TEST POINT WITH PIX TUNED IN
VARIES -11 TO 0V WITH HORIZ HOLD
CONTROL
21
22
13
24
25
SYNC
SEPARATOR
R417
18K
C406
150
N150
R500 470K
R501 470K
E500
E501
20
C500
.001
C501
.001
Z5F
C502
.0018
R502
220K
R503
47K
C503
.15
100V
-5V
R504
270K
R506
6.8M
TO B+
135V
V4A
HORIZ OSC
1/2 - 6BL8
175
6
-10
2
135
3
C504
470
10%
Z5F
C505
.005
10%
400V
C506
.022
68V
R505
1.8K
R511
100K
1W
B+
270V
R507
47K
C508
.005
Z5U
R508
22K
B+
C507
.001
10%
Z5F
R510
1M
HORIZ
OUTPUT
58-2504-A

FIGURE 35 - TS-594 HORIZONTAL OSCILLATOR & AFC CIRCUITRY

HORIZONTAL SWEEP SYSTEM

The horizontal oscillator and AFC circuit for the TS-594 is shown in Figure #35. You will notice that this circuit is almost identical to the one currently used in all tube receivers.

SERVICING THE OSCILLATOR AND AFC

The same servicing methods currently used on tube sets should be used here.

1. To determine oscillator strength, you should short the AFC test point to chassis and measure the voltage on pin #11 (control grid) of the horizontal output tube. A low reading would indicate a lack of oscillator strength. Resistors, capacitors and the oscillator coil should be checked.

2. To determine if the oscillator frequency is correct, the AFC test point should be shorted to the chassis and while viewing the picture, see if some setting of the horizontal hold adjustment will place it on frequency. If not, the oscillator coil and associated capacitors should be checked.

3. To determine the AFC pull-in range, a voltmeter should be connected to the AFC test point. If the pull-in range is correct, this voltage should vary between 0 and -11V as the horizontal hold is adjusted (picture in sync). Inability to accomplish this would likely be caused by a defective diode, a loss of reference pulse from the high voltage transformer or defective resistor or capacitor.

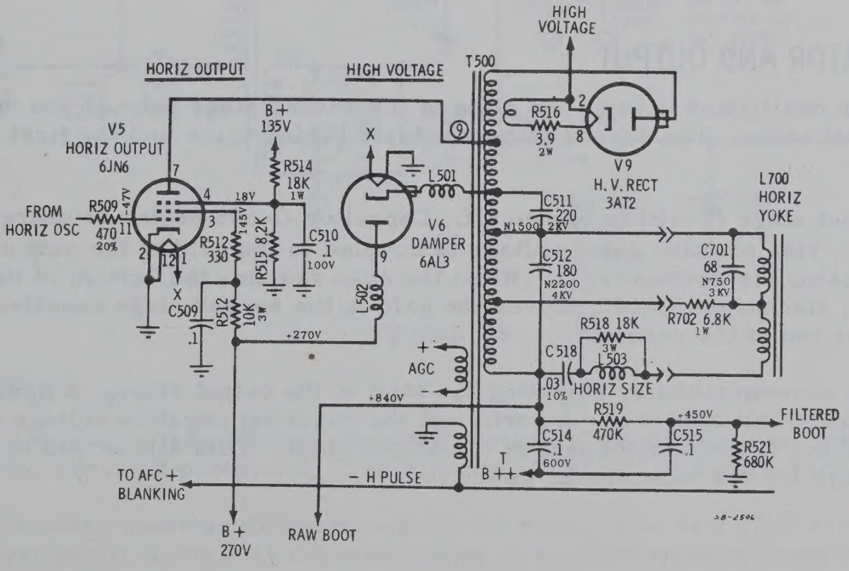

HORIZ OUTPUT
HIGH VOLTAGE
HIGH
VOLTAGE
T500
V5
HORIZ OUTPUT
6JN6
FROM
HORIZ OSC
R509
470
20%
-47V
7
4
3
11
2
12
1
X
C509
.1
18V
145V
R512
330
R512
10K
3W
B+
135V
R514
18K
1W
R515 8.2K
C510
.1
100V
+270V
X
L501
V6
DAMPER
6AL3
9
L502
9
R516
3.9
2W
2
8
V9
H.V. RECT
3AT2
C511
220
N1500
2KV
C512
180
N2200
4KV
L700
HORIZ
YOKE
C701
68
N750
3KV
R702 6.8K
1W
R518 18K
3W
C518
L503
.03
10%
HORIZ SIZE
+
AGC
-
+840V
R519
470K
+450V
C514
.1
600V
C515
.1
R521
680K
FILTERED
BOOT
T
B++
- H PULSE
TO AFC +
BLANKING
B+
270V
RAW BOOT
58-2506

FIGURE 36 - TS-594 HORIZONTAL OUTPUT & HV CIRCUITRY

HORIZONTAL OUTPUT AND HV CIRCUITS

This circuitry is shown in Figure #36. You will notice that this circuitry is also very similar to ar all tube receiver.

The usual service procedures apply here. The DC voltages should be checked first. The voltage on the grid of the horizontal output tube is a very important one as it is a measure of the oscillator drive. A low reading indicates a lack of output from the horizontal oscillator. The transformer and yoke can be checked for continuity with an ohmmeter. Shorted turns can best be located with a commercially available "flyback" checker or by substituting known good parts. Tubes should be checked by substituting known good ones.

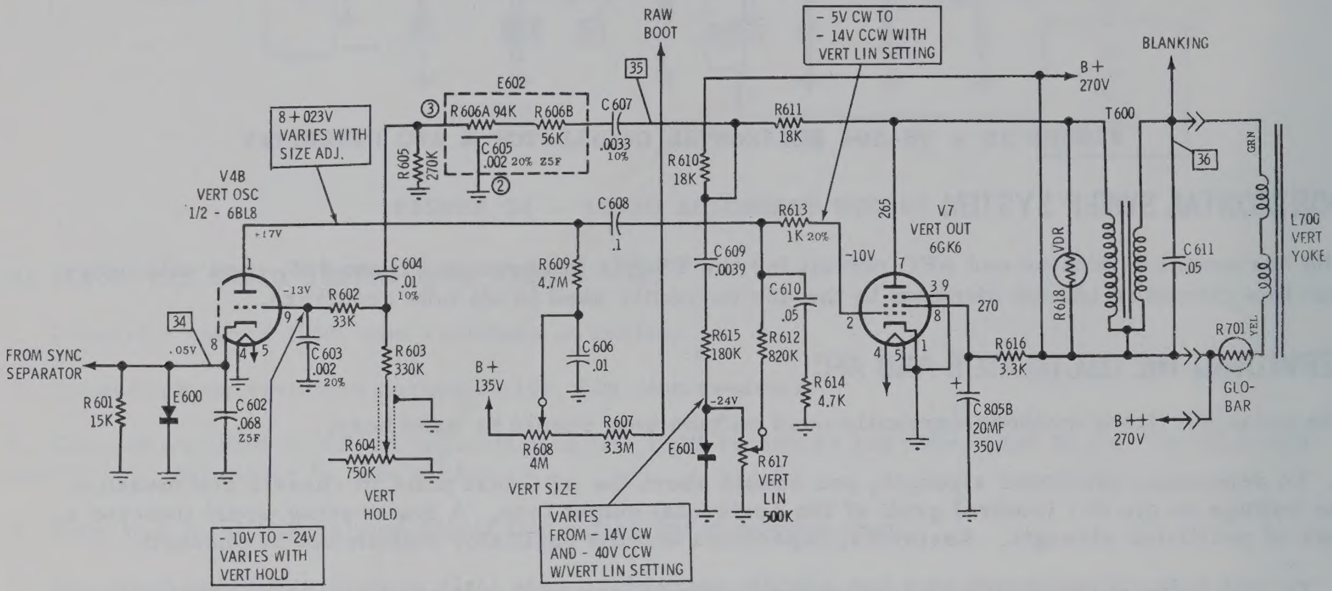

RAW BOOT
35
- 5V CW TO - 14V CCW WITH VERT LIN SETTING
BLANKING
B+ 270V
E602
③
R606A 94K
R606B 56K
C607 .0033 10%
C605 .002 20% Z5F
②
R605 270K
8+023V VARIES WITH SIZE ADJ.
V4B VERT OSC 1/2 - 6BL8
+17V
R610 18K
R611 18K
T600
36
GRN
C608 .1
R613 1K 20%
265
V7 VERT OUT 6GK6
L700 VERT YOKE
C604 .01 10%
-13V
R602 33K
R609 4.7M
C609 .0039
-10V
VDR
R618
C611 .05
34
C610 .05
3 9
270
C603 .002 20%
R603 330K
C606 .01
R615 180K
R612 820K
R616 3.3K
R701 YEL
FROM SYNC SEPARATOR
.05V
8
4 5
1 9
B+ 135V
R614 4.7K
2 7 8 1 4 5
GLO-BAR
R601 15K
E600
C602 .068 Z5F
R604 750K
VERT HOLD
R608 4M
R607 3.3M
VERT SIZE
-24V
E601
R617 VERT LIN 500K
C805B 20MF 350V
B++ 270V
- 10V TO - 24V VARIES WITH VERT HOLD
VARIES FROM - 14V CW AND - 40V CCW W/VERT LIN SETTING

FIGURE 37 - TS-594 VERTICAL SWEEP CIRCUITRY

VERTICAL SWEEP SYSTEM

The vertical sweep system is a plate coupled multi-vibrator. It too is very similar to an all tube set. The circuitry is shown in Figure #37.

VERTICAL OSCILLATOR AND OUTPUT

Feed-back to sustain oscillation is from the plate of the second stage through the res-cap assembly to the grid of the first stage. The second stage conducts during trace and the first stage during retrace.

During trace, the first stage (V-4B) is turned off. Capacitor C-606 begins to charge through the size control, R-608. This positive going voltage is coupled to the grid of the output stage (V-7) turning it on and causing the vertical scan. When the scan reaches the bottom of the screen, the first stage conducts, discharges C-606, drives the grid in the second stage negative and allows the trace to return to the top of the screen.

Vertical linearity is accomplished by adjusting the bias on the output stage. A portion of the vertical output signal is rectified by E-601. A portion of the resulting negative voltage is selected by the linearity control and fed to the control grid of the output stage. This allows you to adjust the operating point of the stage for the most linear sweep.

The speed of the vertical sweep is controlled by the sync information fed into the cathode of the first stage. For normal operation, the vertical hold control is adjusted so that the speed is slightly below the required 60 CPS. The negative going sync pulse which is fed to the cathode drives the tube into conduction slightly before it would normally if the pulse were not present. This speeds the oscillator up and allows the pulse to control it.

Diode E-600 is connected in series with the cathode of the first stage. Its purpose is to make the impedance (cathode to ground) high when the tube is not conducting so that the sync pulse can be injected and low when the tube is conducting. When the tube is not conducting, the diode has no forward bias and is open. When the tube starts to conduct, the diode conducts and shorts out the cathode resistor, R-601.

SERVICING THE VERTICAL SWEEP SYSTEM

Servicing the sweep system primarily consists of voltage and resistance measurements. These tests should disclose most defects. If the circuit should stop oscillating for any reason, the plate voltage of the first stage will drop to a very low value.

This is usually a symptom of the problem rather than the cause of the failure.

If diode E-600 should short, you would notice only a loss of vertical sync.

A defective E-601 diode can best be detected by comparing the developed DC voltages to the schematic.

The vertical output transformer and the yoke can be checked for continuity with an ohmmeter. Shorted turns or other defects are best determined by substituting a known good replacement part.

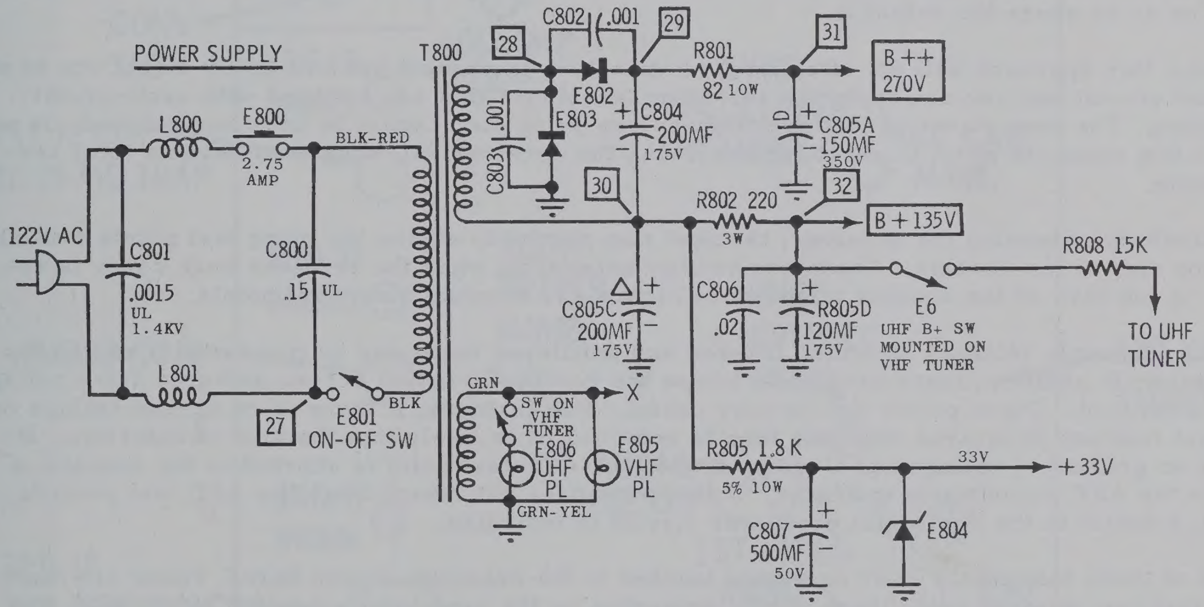

POWER SUPPLY
T800
C802
.001
28
29
31
R801
82 10W
B++
270V
E802
E803
.001
C803
C804
200MF
175V
C805A
150MF
350V
30
32
R802 220
3W
B+135V
L800
E800
2.75
AMP
BLK-RED
122V AC
C801
.0015
UL
1.4KV
C800
.15
UL
C805C
200MF
175V
C806
.02
R805D
120MF
175V
E6
UHF B+ SW
MOUNTED ON
VHF TUNER
R808 15K
TO UHF
TUNER
L801
BLK
27
E801
ON-OFF SW
GRN
SW ON
VHF
TUNER
E806
UHF
PL
E805
VHF
PL
X
GRN-YEL
R805 1.8 K
5% 10W
33V
+33V
C807
500MF
50V
E804

FIGURE 38

THE POWER SUPPLY

The TS-594 power supply is transformer operated and has a circuit breaker connected with the primary winding for overload protection. The circuitry is shown in Figure #38.

There are two secondary windings on the power transformer. One is a 6.3V AC winding and supplies all the tube filament power as well as the pilot lights. The other winding feeds two silicon rectifiers connected as a full wave voltage doubler.

There are four B+ voltages available from the supply; B++ 285, B++ 270, B+ 135 and a regulated +33V for the transistor circuitry. Regulation is provided by a Zener diode.

SERVICING THE POWER SUPPLY

Servicing this power supply is straight forward and should not present a problem. To check for normal operation, the B++ 285 point should be checked first. A low voltage reading would indicate an open diode (E-802 or E-803) or an open filter condenser (C-804 or C-805). A shorted diode or filter capacitor would likely cause the circuit breaker to open.

A low reading at the B++ 270 or B+ 135 points would likely indicate that something is drawing excessive current from that buss.

The +33V buss is regulated by a 33V 10% Zener diode. The voltage on this buss should be between 30 and 36V. A lower reading would indicate a change in value of R-805 or excessive current drain by a defective stage. A higher reading would indicate a defective Zener diode.

GENERAL SERVICING

Before any attempt is made to trouble-shoot any individual circuit, an effort should be made to determine which circuit actually contains the defect. This is one of the more important preliminary steps in servicing.

Carefully observe all aspects of performance. If the screen is dark, notice if the sound is normal. If there is picture present, observe it carefully while adjusting the normal customer controls. Many times this will offer some clue as to which circuit is not performing correctly.

If the receiver exhibits no sound and no picture, efforts should be directed toward restoring the picture first. This may also restore the sound, but if it doesn't, the picture performance may give some clue as to where the defect is.

Obviously, this approach will not often locate a defective component but will likely direct you to an individual circuit and you can apply the servicing techniques that are outlined with each circuit description. The importance of this preliminary servicing step cannot be over emphasized. In many cases, a few moments spent in carefully observing the receiver will save considerable total servicing time.

After carefully observing the receiver, the next step can be to utilize the many test points available on the top side of the chassis. These are readily accessible when the receiver back cover is removed. A top view of the chassis is shown in Figure #17 showing many test points.

Note that all supply voltages including filtered and unfiltered boost can be measured from the top of the chassis. In addition, there are points where the horizontal output screen and grid drive voltages can be measured. These points can be very useful. For instance, if there is no screen voltage on the output tube and it returns when the tube is removed, it is likely that the tube is defective. If there is no grid drive voltage and it returns when the AFC test point is shorted to the chassis, a defect in the AFC circuitry is indicated. If the drive does not return when the AFC test point is shorted, a defect in the horizontal oscillator circuit is indicated.

The use of these test points is by no means limited to the examples shown here. There are many checks that can be made using these points depending on the symptoms exhibited by the set. The lugs where the circuit board connects to the rest of the circuitry can also be used for testing. These points are all identified on the schematic diagram.

If the above does not disclose a defect that can be remedied from the top side of the chassis, the bottom cover should be removed. This can be done by removing the six retaining screws which are all readily apparent.

With both the rear and bottom covers removed, all circuitry is accessible. Circuit analysis similar to that outlined in the individual circuit discussion sections should be followed.

Every effort should be made to positively identify a defective soldered in component before attempts are made to exchange or remove it.

Once a defective component is identified as accurately as possible, it should be removed for further checking or replacement. Standard techniques for removing components should be followed. If it is a two lug component, it can usually be removed by heating the solder joints, one end at a time, while gently pulling up on the component. If it is a multi-lug, an iron with a solder sucking attachment can be used to remove the solder from the individual terminals allowing removal. A solder pot can also be used for the same purpose. Flush cutting pliers can also be used to cut off the individual lugs so that they can be removed one at a time.

A low wattage soldering iron should always be used, never exceeding 50 watts. The use of a larger iron can cause damage to the etched circuitry.

If for some reason, it becomes desirable to remove a badly damaged board, the leads should be removed first. The service manual contains a pictorial diagram showing the connections so that the wires can be easily re-installed.

The board itself can then be removed. You can use a solder sucking iron to remove the solder from the seven mounting lugs and then remove the board. You can also heat the lugs individually while pulling upward on the board. This should be done in steps working around the panel. Do not force the board too far upward in any step or it could be damaged.

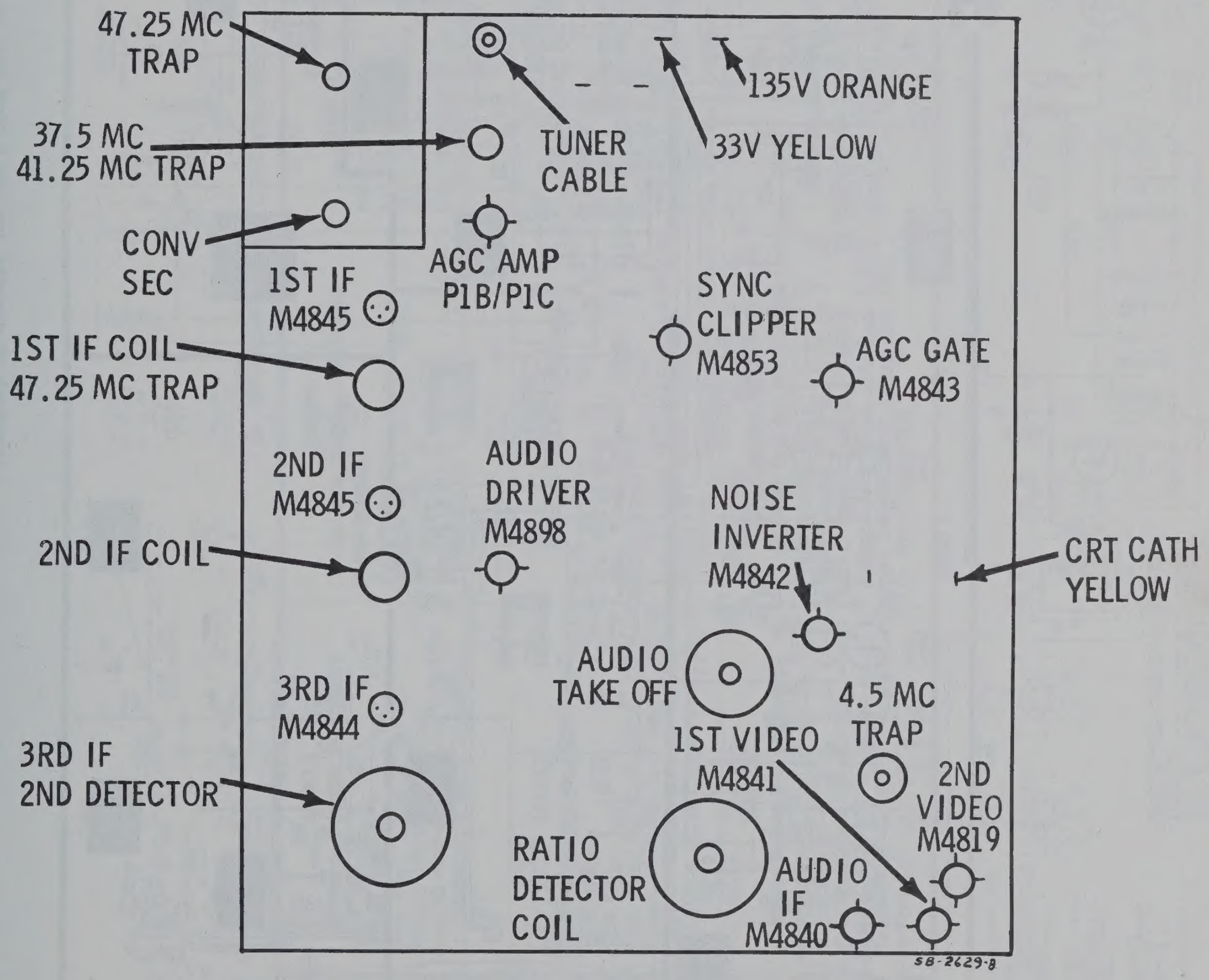
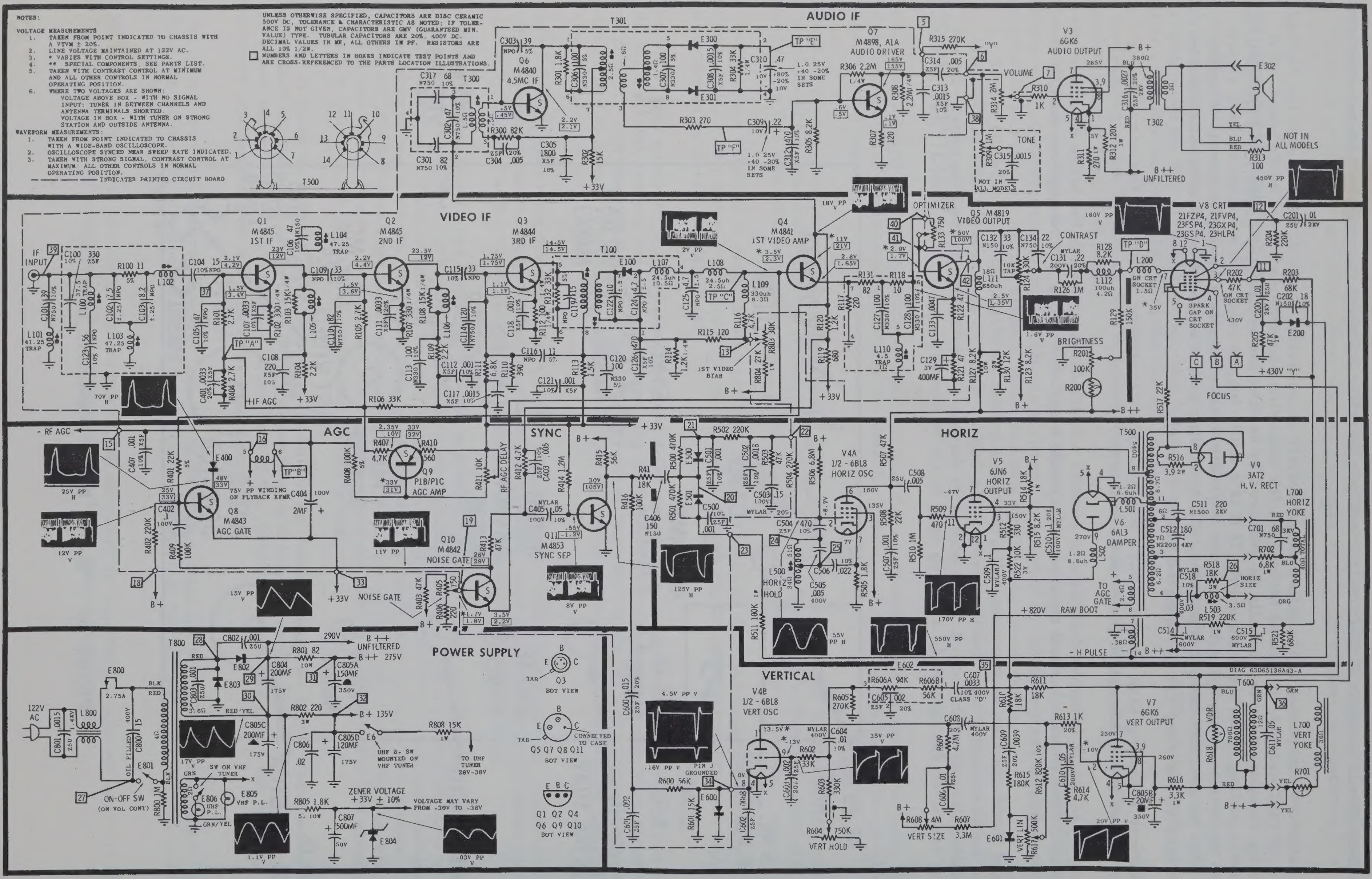

47.25 MC TRAP
37.5 MC 41.25 MC TRAP
CONV SEC
1ST IF COIL 47.25 MC TRAP
2ND IF COIL
3RD IF 2ND DETECTOR
TUNER CABLE
135V ORANGE
33V YELLOW
AGC AMP P1B/P1C
1ST IF M4845
SYNC CLIPPER M4853
AGC GATE M4843
2ND IF M4845
AUDIO DRIVER M4898
NOISE INVERTER M4842
CRT CATH YELLOW
AUDIO TAKE OFF
3RD IF M4844
4.5 MC TRAP
1ST VIDEO M4841
2ND VIDEO M4819
RATIO DETECTOR COIL
AUDIO IF M4840
SB-2629-8

FIGURE 39 - TS-594 PANEL COMPONENT LOCATION



NOTES:

VOLTAGE MEASUREMENTS

1. TAKEN FROM POINT INDICATED TO CHASSIS WITH A VTVM ± 20%.
2. LINE VOLTAGE MAINTAINED AT 122V AC.
3. * VARIES WITH CONTROL SETTINGS.
4. ** SPECIAL COMPONENTS. SEE PARTS LIST.
5. TAKEN WITH CONTRAST CONTROL AT MINIMUM AND ALL OTHER CONTROLS IN NORMAL OPERATING POSITION.
6. WHERE TWO VOLTAGES ARE SHOWN:
   VOLTAGE ABOVE BOX - WITH NO SIGNAL INPUT: TUNER IN BETWEEN CHANNELS AND ANTENNA TERMINALS SHORTED.
   VOLTAGE IN BOX - WITH TUNER ON STRONG STATION AND OUTSIDE ANTENNA.

WAVEFORM MEASUREMENTS:

1. TAKEN FROM POINT INDICATED TO CHASSIS WITH A WIDE-BAND OSCILLOSCOPE.
2. OSCILLOSCOPE SYNCED NEAR SWEEP RATE INDICATED.
3. TAKEN WITH STRONG SIGNAL, CONTRAST CONTROL AT MAXIMUM. ALL OTHER CONTROLS IN NORMAL OPERATING POSITION.

— — — — INDICATES PRINTED CIRCUIT BOARD

UNLESS OTHERWISE SPECIFIED, CAPACITORS ARE DISC CERAMIC 500V DC, TOLERANCE & CHARACTERISTIC AS NOTED; IF TOLERANCE IS NOT GIVEN, CAPACITORS ARE GMV (GUARANTEED MIN. VALUE) TYPE. TUBULAR CAPACITORS ARE 20%, 400V DC. DECIMAL VALUES IN MF, ALL OTHERS IN PF. RESISTORS ARE ALL 10% 1/2W.

☐ NUMBERS AND LETTERS IN BOXES INDICATE TEST POINTS AND ARE CROSS-REFERENCED TO THE PARTS LOCATION ILLUSTRATIONS.

T500
AUDIO IF
T301
T300
Q6 M4840 4.5MC IF
Q7 M4898, A1A AUDIO DRIVER
V3 6GK6 AUDIO OUTPUT
VOLUME
TONE
NOT IN ALL MODELS
T302
E302
B++ UNFILTERED
VIDEO IF
IF INPUT
Q1 M4845 1ST IF
Q2 M4845 2ND IF
Q3 M4844 3RD IF
T100
Q4 M4841 1ST VIDEO AMP
1ST VIDEO BIAS
OPTIMIZER
Q5 M4819 VIDEO OUTPUT
CONTRAST
BRIGHTNESS
V8 CRT 21FZP4, 21FVP4, 23FSP4, 23GXP4, 23GSP4, 23HLP4
SPARK GAP ON CRT SOCKET
FOCUS
+430V "Y"
AGC
- RF AGC
+IF AGC
Q8 M4843 AGC GATE
75V PP WINDING ON FLYBACK XFMR
Q9 P1B/P1C AGC AMP
RF AGC DELAY
Q10 M4842 NOISE GATE
NOISE GATE
SYNC
Q11 M4853 SYNC SEP
HORIZ
V4A 1/2 - 6BL8 HORIZ OSC
L500 HORIZ HOLD
V5 6JN6 HORIZ OUTPUT
V6 6AL3 DAMPER
TO AGC GATE
RAW BOOT
T500
V9 3AT2 H.V. RECT
L700 HORIZ YOKE
HORIZ SIZE
- H PULSE
POWER SUPPLY
122V AC
ON-OFF SW (ON VOL CONT)
OIL FILLED
T800
SW ON VHF TUNER
UHF P.L.
VHF P.L.
UHF B+ SW MOUNTED ON VHF TUNER
TO UHF TUNER 28V-38V
ZENER VOLTAGE +33V ± 10%
VOLTAGE MAY VARY FROM +30V TO +36V
Q3 BOT VIEW
Q5 Q7 Q8 Q11 BOT VIEW
CONNECTED TO CASE
Q1 Q2 Q4 Q6 Q9 Q10 BOT VIEW
VERTICAL
V4B 1/2 - 6BL8 VERT OSC
PIN J GROUNDED
VERT HOLD
VERT SIZE
VERT LIN
V7 6GK6 VERT OUTPUT
T600
L700 VERT YOKE
DIAG 63D65136A43-A

MOTOROLA TV CHASSIS JTS-594 & 22TS-594

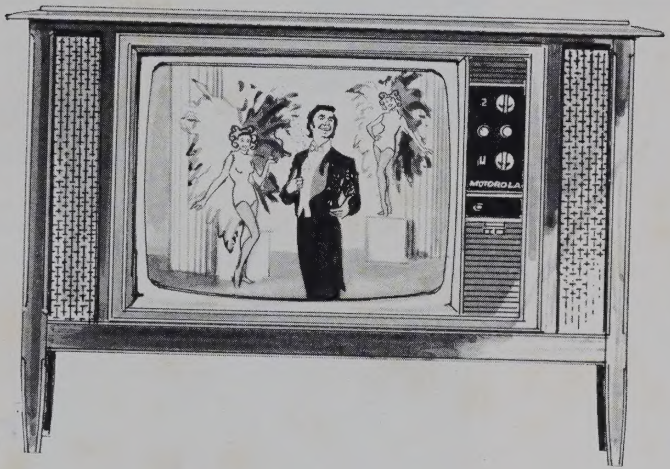
TRANSISTOR SPECIFICATIONS

M4819 **Motorola Part No. 48S134819** NPN Silicon Video Output Max. Pwr. 1.2W @ 60°C BV_{CEO} 180V @ I_C 1ma H_{FE} 50 min @ I_C 30ma V_{CE} 10V f_T 150mc min @ I_C 20ma V_{CE} 20V	**M4840** **Motorola Part No. 48S134840** NPN Silicon 4.5mc Amp Max. Pwr. 210mw @ 60°C BV_{CEO} 25V @ I_C 1ma H_{FE} 50-150 @ I_C 10ma V_{CE} 10V f_T 200mc @ I_C 10ma V_{CE} 15V	**M4841** **Motorola Part No. 48S134841** NPN Silicon 1st Video Amp Max. Pwr. 210mw @ 60°C BV_{CEO} 40V @ I_C 1ma H_{FE} 100-300 @ I_C 10ma V_{CE} 10V f_T 200mc @ I_C 10ma V_{CE} 15V	**M4842** **Motorola Part No. 48S134842** NPN Silicon Noise Gate Max. Pwr. 210mw @ 60°C BV_{CEO} 40V @ I_C 1ma H_{FE} 50-200 @ I_C 10ma V_{CE} 10V f_T Not Critical
M4843 **Motorola Part No. 48S134843** NPN Silicon AGC Gate Max. Pwr. 1.2W @ 60°C BV_{CEO} 140V @ I_C 1ma H_{FE} 50-150 @ I_C 10ma V_{CE} 10V f_T 150mc @ I_C 20ma V_{CE} 20V	***M4844** **Motorola Part No. 48S134844** NPN Silicon 3rd Video IF Max. Pwr. 375mw @ 60°C BV_{CEO} 20V @ I_C 1ma H_{FE} 25 min @ I_C 10ma V_{CE} 10V 45mc Pwr. Gain 35db avg	***M4845** **Motorola Part No. 48S134845** NPN Silicon Video IF (Forward AGC) Max. Pwr. 210mw @ 60°C BV_{CEO} 40V @ I_C 2ma H_{FE} 40-120 @ I_C 4ma V_{CE} 10V 45 mc. Pwr. Gain 33db avg	**M4853** **Motorola Part No. 48S134853** NPN Silicon Sync Separator Max. Pwr. 1.2W @ 60°C BV_{CEO} 140V @ I_C 1ma H_{FE} 75 min @ I_C 10ma V_{CE} 10V f_T 150mc @ I_C 20ma V_{CE} 20V
M4898 **Motorola Part No. 48S134898** NPN Silicon Audio Driver Max. Pwr. .6W @ 60°C BV_{CEO} 300V @ I_C .1ma H_{FE} 30-120 @ I_C 1ma V_{CE} 10V f_T Not Critical	**M4909 P1B** **Motorola Part No. 48S134909** PNP Silicon AGC Amp Max. Pwr. 210mw @ 60°C BV_{CEO} -40V @ I_C 1ma H_{FE} 50-200 @ I_C 10ma V_{CE} 10V f_T Not Critical	**DIODE** **Motorola Part No. 48S67120A09** AGC Gate Diode PIV 160 Volts Recovery Time 1.6 μ sec	**ZENER DIODE** **Motorola Part No. 48S134858** Zener E 33V $\pm$ 10% Max. Pwr. 1 Watt

*SPECIAL APPLICATION USED IN TS594 CHASSIS

MOTOROLA

BLACK AND WHITE TV



featuring "Quick-Set" Picture Control for 1972

MOTOROLA

BLACK AND WHITE TV

featuring "Quick-Set" Picture Control for 1972

GUARANTEE

portable black and white TV*

ONE YEAR GUARANTEE ON ALL COMPONENT PARTS
FREE 90-DAY CARRY-IN SERVICE

For ninety days from purchase date, Motorola guarantees to pay labor charges for correction of product defects. For one year from purchase date, Motorola guarantees to exchange all defective parts. Exchange made with remanufactured Motorola parts. Guarantee is effective only when carried to and serviced by a Motorola authorized servicer during normal working hours. Guarantee does not cover installation, set-up, travel time or mileage, antenna system, adjustment of customer controls, foreign use (except Canada) or damage due to owner misuse.

* including model XT630H

console black and white TV*

ONE YEAR GUARANTEE ON ALL COMPONENT PARTS

For one year from purchase date, Motorola guarantees to exchange all defective parts. Exchange made with remanufactured Motorola parts. Labor charges are not included in this guarantee. They are paid by the owner. Guarantee is effective only when serviced by a Motorola authorized servicer during normal working hours. Guarantee does not cover installation, set-up, travel time or mileage, antenna system, adjustment of customer controls, foreign use (except Canada) or damage due to owner misuse.

* including table model XT778H.

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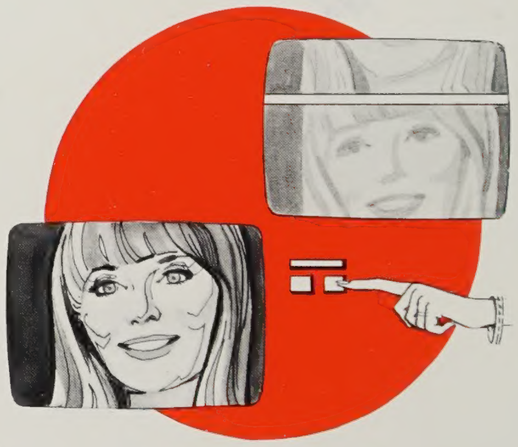
Printed in U.S.A.

MOTOROLA

QUICK-SET

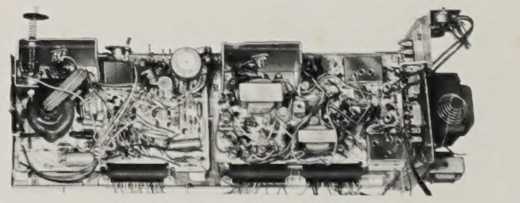
picture control



Simulated demonstration

Operating a Motorola Black and White TV can be as easy as pushing a button with our latest QUICK-SET picture control feature. Now one button automatically adjusts brightness, contrast and vertical hold. Should someone misadjust any of these controls, just push the button and the picture is back where it was. (On models indicated.)

SOLID STATE

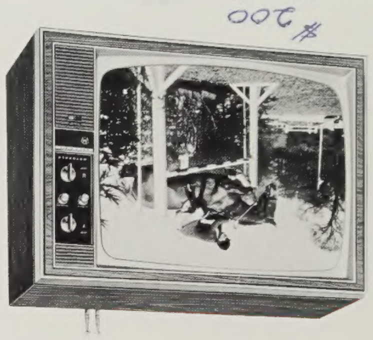


Enjoy the reliability and long-life benefits of solid state components in Motorola sets with a 100% solid state chassis—no tubes. Unlike solid state components, tubes have heating filaments that can cause them to lose power, gradually lose performance and eventually burn out. You can select small screen solid state sets in 9" and 12" screen sizes (measured diagonally) and in big screen 21" and 22" sizes (measured diagonally) for portables, table and console models. In big screen solid state models, chassis components are mounted on plug-in mini-circuits (like they are in Motorola Quasar Color TV sets) for quick, easy service.

INSTANT PICTURE AND SOUND

Turn on your TV set and presto . . . picture and sound! There's little waiting—even in tube sets, because a special circuit keeps the chassis tubes in a "standby" condition for almost instant operation the moment the set is turned on. This feature is available in all 1972 models except BP309H and BP521G.

MOTOROLA SOLID STATE BLACK AND WHITE TV WITH QUICK-SET PICTURE CONTROL



#200

22" measured diagonally

deluxe table TV

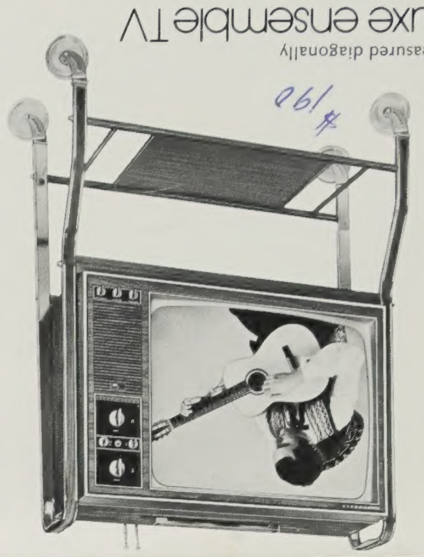
Our biggest black and white TV picture size—282 square inches viewing area. The reliability of 100% solid state chassis—no tubes. "Quick-Set" picture control. Instant Picture and Sound. Many other outstanding features. Handsomely finished cabinet in Walnut grain on metal 18⅜" H, 25¾" W, 15⅞" deep. **Model XT778HW**

#210

22" measured diagonally

contemporary console TV

Exceptional value. Our finest solid state chassis, fully featured, and our biggest black and white screen size—282 square inches—in a cabinet of Northern Walnut vinyl finish on wood materials. 27¼" W, 29⅜" H, 14¼" D. **Model XU779HW**



#190

21" measured diagonally

deluxe ensemble TV

Move this ensemble about the house. The cart is included. Big 229 square inch picture . . . 100% solid state chassis—no tubes . . . plus outstanding "Quick-Set" picture control and Instant Picture and Sound. Handsome cabinet finished in Walnut grain vinyl on metal. 17⅛" H, 24⅛" W, 14¼" D. **Model XT630HW**

#250

22" measured diagonally

contemporary console TV

Low in profile, this elegantly fashioned cabinet is finished in Oil Walnut on genuine Tiama Mahogany veneers and select solids. Features "Quick-Set" picture control, Instant Picture and Sound and many more outstanding features found in our solid state chassis models. 40" W, 29⅝" H, 15¾" D. **Model XL780HW**

All pictures shown on screens simulate TV reception.

#250

22" measured diagonally

early american console TV

Here's one of our finest. A solid state solid chassis, fully featured and biggest available black and white picture in a cabinet that reflects the warmth and charm of Colonial furniture. Genuine Birch veneers and select solids are finished in Brushed Glaze Maple. 29¼" W, 32⅛" H, 15¼" D. **Model XU781HS**

#270

22" measured diagonally

mediterranean credenza TV

Full-to-the-floor credenza design provides the accent to this fully-featured solid state black and white TV. A Moreno Oak finish on genuine Oak veneers and Oak solids provide bold Mediterranean styling with decorative detail in molded simulated wood materials. 31¾" W, 27⅝" H, 16" D. **Model XU782HK**

GUARANTEE

portable black and white TV*

ONE YEAR GUARANTEE ON ALL COMPONENT PARTS
FREE 90-DAY CARRY-IN SERVICE

For ninety days from purchase date, Motorola guarantees to pay labor charges for correction of product defects. For one year from purchase date, Motorola guarantees to exchange all defective parts. Exchange made with remanufactured Motorola parts. Guarantee is effective only when carried to and serviced by a Motorola authorized servicer during normal working hours. Guarantee does not cover installation, set-up, travel time or mileage, antenna system, adjustment of customer controls, foreign use (except Canada) or damage due to owner misuse.

* including model XT630H

console black and white TV*

ONE YEAR GUARANTEE ON ALL COMPONENT PARTS

For one year from purchase date, Motorola guarantees to exchange all defective parts. Exchange made with remanufactured Motorola parts. Labor charges are not included in this guarantee. They are paid by the owner. Guarantee is effective only when serviced by a Motorola authorized servicer during normal working hours. Guarantee does not cover installation, set-up, travel time or mileage, antenna system, adjustment of customer controls, foreign use (except Canada) or damage due to owner misuse.

* including table model XT778H.

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Form No. 27153

Printed in U.S.A.

MOTOROLA®

KT133DM

PART NO. 1U65534A82

PANEL REMOVAL AND INSTALLATION INSTRUCTIONS

VIDEO IF PANEL "B" - CHASSIS TS-915 AND TS-919

NOTE: READ SPECIAL NOTES FOR SPECIFIC INFORMATION BEFORE REMOVING PANELS.

PANEL REMOVAL Most panels can be removed by lifting panel off nylon mounting studs with fingers. Apply just enough pressure at the stud to free panel from studs. Then, lift panel off connectors.

Areas where panels are not readily accessible by hand, panels may be pried off their mounting studs. *Extreme care should be taken to avoid fracturing panels.* Use a flat tool (preferably insulated), apply tool between panel and chassis. Lift panel off studs by applying pressure at the edge of panel and adjacent to studs only. Free each stud, then lift panel off connectors by hand.

PANEL INSTALLATION Position replacement panel on nylon mounting studs. Make certain panel connecting plugs are aligned with chassis connecting plugs.

Use a dull flat tool, preferably a hollow tool such as a spintite wrench. Place spintite wrench over nylon mounting stud and press panel into position. On panels that are not readily accessible with a spintite wrench, place a dull flat tool adjacent to mounting stud (away from corner of panel) and press into position. NOTE: Make certain all panel screws are in place and tight, to insure proper grounding of panel. Replace all connections and make necessary adjustments. See special notes.

SPECIAL NOTES:

1. TS-915 only—Remove three (3) panel grounding screws, located on top of chassis and panel shield grounding clip on rear of panel.

NOTE: If a shield exists between video IF panel "B" and video amp. panel "E" it will be necessary to remove this shield. First, remove panel "E." Then, loosen two (2) bottom shield grounding screws at rear of panel "B." Also remove 2 screws from the top of this shield.

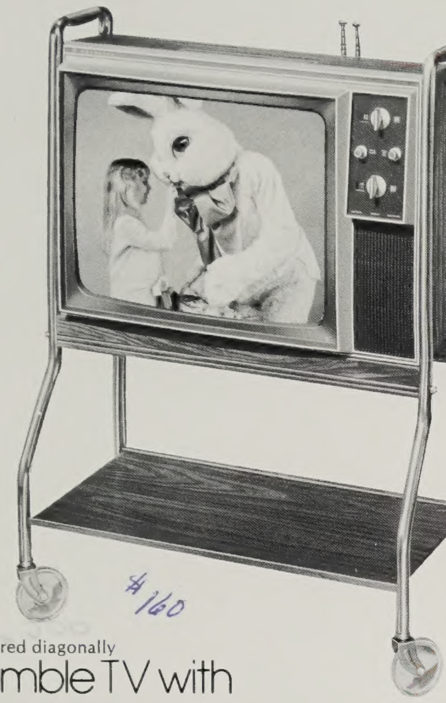
2. 23TS-919 only—Remove shield on bottom of cabinet, then, remove three (3) panel grounding screws and panel shield grounding clip on bottom of panel.
3. 20TS-919 — Slide chassis to service position, remove (3) panel grounding screws and grounding clip. — See label on bottom of panel.

NOTE: If a shield exists between video IF panel "B" and video amp. panel "E," remove the two (2) shield grounding screws.

4. Disconnect blue lead and white wire feeding VHF tuner.
5. Unplug tuner cable from panel.
6. Remove one (1) shield retaining screw from panel on top of panel "B" and remove shield. Lift panel and shield off IF shield and disconnect green lead and red B+ lead from IF panel.
7. INSTALLATION: The replacement panel is equipped with two (2) B+ lugs. One is located under the IF shield (RF choke in some panels), and is used for the FTL or AFC panel. The other is located outside of the IF shield near capacitor C-37B; it is identified as +35V, and is used for the F.T.I. panel. This lug (bullet head type in some sets—white wire to VHF tuner) formerly located adjacent to the RF AGC delay control, is now located near capacitor C-37B.

MOTOROLA

BIG SCREEN PORTABLES



$160

19″ measured diagonally ensemble TV with instant picture and sound

An ensemble big screen performer. Includes its own roll-about cart. VHF dipole telescoping antenna. Handsome Walnut grain finish on high impact plastic cabinet. 16½″ H, 22½″ W, 13½″ D. **Model BP530HW**

$145

19″ measured diagonally deluxe portable TV with instant picture and sound

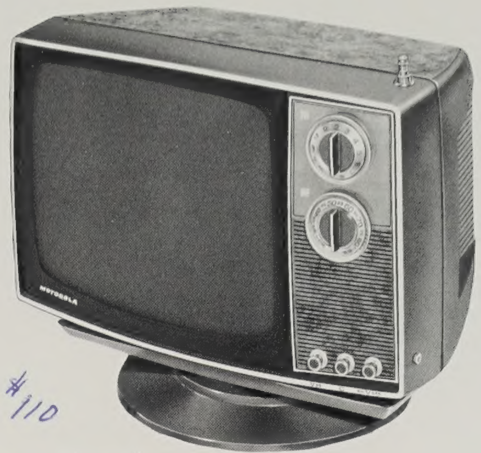
With a built-in VHF dipole antenna system to help pull in a strong TV signal, you can enjoy a sharp, bright picture the moment you turn the set on. Beige color cabinet of high impact plastic. 16½″ H, 22½″ W, 13½″ D. **Model BP523HN**

19″ measured diagonally portable TV

$140

This performance pacer helps give you a bright, sharp picture on a 184 square inch screen. Easy to read channel numbers in windows. Monopole VHF antenna. Charcoal Brown color cabinet in high impact plastic. 16½″ H, 22½″ W, 13½″ D. **Model BP521GN**

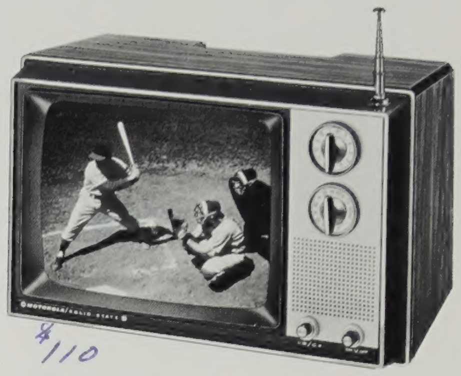
All pictures shown on screens simulate TV reception.



$110

12″ measured diagonally solid state portable TV

Elegance plus the reliability and long life of a 100% solid state chassis—no tubes. Instant Picture and Sound. A 360° Carousel swivel base. Detachable sun shield. Magic-Mast VHF up-front antenna. Earphone jack. Lighted dial. Handsome sculptured high impact plastic cabinet with Carpathian Elm Burl finish. Recessed side handle. 11¾″ H, 15¼″ W, 10⅜″ D. **Model XP320GU**



$110

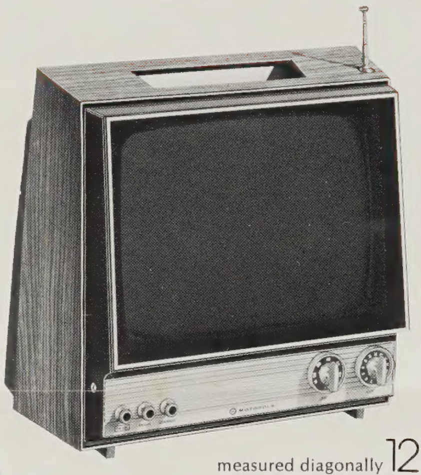
9″ measured diagonally solid state AC/DC portable TV

Take TV enjoyment everywhere. This model plays indoors on regular AC current, plays outdoors on battery (optional extra), and plays in your car connected to cigarette lighter. 100% solid state chassis—no tubes. A 40 square inch screen, with instant picture and sound. Earphone jack, Magic-Mast up-front VHF antenna. Snap-on sun shield. Walnut grain finished cabinet of high impact plastic. 8⅛″ H, 12½″ W, 9⅝″ D. **Model XP259FW**

Portable Battery Charger (KT236HB) and Battery (KT250HB) available as optional extras.

TOTEABLES

All pictures shown on screens simulate TV reception.



$100

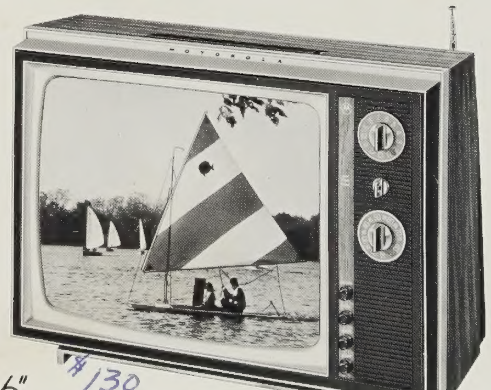
measured diagonally 12″ portable TV with instant picture and sound

Smartly styled with a detachable sun shield included. A 74 square inch instant picture. Earphone jack for private listening. Magic-Mast up-front VHF antenna. High impact plastic cabinet in Walnut grain finish. 13⅝″ H, 13⅞″ W, 10″ D. **Model BP318HW**

12″ measured diagonally portable TV

$90

This one packs plenty of performance to help give you a crisp, bright picture. Motorola's Fast-Back chassis slides out the back for easy service access. High impact plastic cabinet in Off-White color. 13⅝″ H, 13⅞″ W, 10″ D. **Model BP309HH**



$130

16″ measured diagonally portable TV with instant picture and sound

Turn on the set and there's instant picture and sound . . . even an earphone jack for private listening. A big 141 square inch picture. Deluxe Walnut grain finished cabinet of high impact plastic. Monopole antenna. 14¾″ H, 20¼″ W, 11¾″ D. **Model BP461HW**

14″ measured diagonally portable TV with instant picture and sound

$110

Striking appearance plus excellent performance in this Toteable model. A 100 square inch instant picture. Earphone jack for private listening. Motorola's Magic-Mast up-front VHF monopole antenna. Deluxe Walnut grain finish on high impact plastic cabinet. 15⅛″ H, 14⅞″ W, 11⅝″ D. **Model BP403HW**

MOTOROLA

BLACK & WHITE TV FEATURES

ALL MODELS

Instant Picture and Sound—(Except models BP309H and BP521G). Your fingers hardly leave the on/off control before you hear sound and see a picture.

Custom-Matic Pre-Set VHF Tuner—You can select your channels and precision fine tune each to the best available signal. Once fine tuned it minimizes the need to fine tune again as you change from channel to channel.

Solid State UHF Tuner—Transistorized to minimize signal drifting when tuned to channels 14-83. Two speed tuning permits selection of channel quickly and then slowly fine tuning for best signal and picture.

Solid State High Voltage Rectifier—(Except models BP461H, BP521G, BP523H, BP530H). A reliable solid state rectifier replaces the tube type high voltage rectifier for improved power supply operation and long life performance.

3-Stage Video IF Amplification System—Utilizes three high gain amplifying components (two in models BP309 and BP318) to help maintain excellent contrast. Input filters help reject adjacent channel interference.

Gated Automatic Gain Control—Helps minimize picture interferences caused by varying signal strength as well as picture flutter caused by airplanes flying overhead.

Out-Front Motorola Golden Voice Speakers—For exceptional sound clarity, each set has a Motorola Golden Voice speaker. Most speaker sizes are 5 x 3″, except Model XP259F—2¾″, XP320G—3″, BP309H, BP318H and BP403H—3½ x 1¾″.

SOLID STATE 21″ and 22″ MODELS

(measured diagonally)

"Quick-Set" Picture Control—One button adjusts contrast, brightness and vertical hold to help simplify operation of your TV set.

"Quick-Set" Indicator Light—When control is activated green light is on. Normal controls for brightness, contrast and vertical hold are inoperable to prevent tampering with pre-set picture quality.

Plug-In Mini-Circuits—Two tubeless mini-circuits plug-in and out for quick easy service . . . just like they do in Motorola Quasar Color TV. These mini-circuits contain most of the components and circuitry necessary for processing TV signals.

Integrated Circuit Audio System—An advanced micro-electronic solid state component replaces multiple components to provide improved reliability in the audio system.

CATV Circuitry—Special circuitry helps provide a steady picture when set is hooked up to a Community Antenna System.

Noise Gate Circuit—Especially helpful in maintaining a steady picture in high traffic areas where automobile ignition noise may cause interference.

OTHER FEATURES

Lighted Channel Indicators—Models XP320G, XT630H, XT778H, XU779H, XL780H, XU781H and XU782H.

Earphone Jack—Models XP259F, BP318H, XP320G, BP403H, BP461H and XT630H.

Roll-about Cart Included—Models BP530H and XT630H.

Sun Shield Included—Models XP259F, BP318H and XP320G.

MOTOROLA®

KT133DM

PART NO. 1U65534A82

PANEL REMOVAL AND INSTALLATION INSTRUCTIONS

VIDEO IF PANEL "B" - CHASSIS TS-915 AND TS-919

NOTE: READ SPECIAL NOTES FOR SPECIFIC INFORMATION BEFORE REMOVING PANELS.

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Areas where panels are not readily accessible by hand, panels may be pried off their mounting studs. *Extreme care should be taken to avoid fracturing panels.* Use a flat tool (preferably insulated), apply tool between panel and chassis. Lift panel off studs by applying pressure at the edge of panel and adjacent to studs only. Free each stud, then lift panel off connectors by hand.

PANEL INSTALLATION Position replacement panel on nylon mounting studs. Make certain panel connecting plugs are aligned with chassis connecting plugs.

Use a dull flat tool, preferably a hollow tool such as a spintite wrench. Place spintite wrench over nylon mounting stud and press panel into position. On panels that are not readily accessible with a spintite wrench, place a dull flat tool adjacent to mounting stud (away from corner of panel) and press into position. NOTE: Make certain all panel screws are in place and tight, to insure proper grounding of panel. Replace all connections and make necessary adjustments. See special notes.

SPECIAL NOTES:

1. TS-915 only—Remove three (3) panel grounding screws, located on top of chassis and panel shield grounding clip on rear of panel.

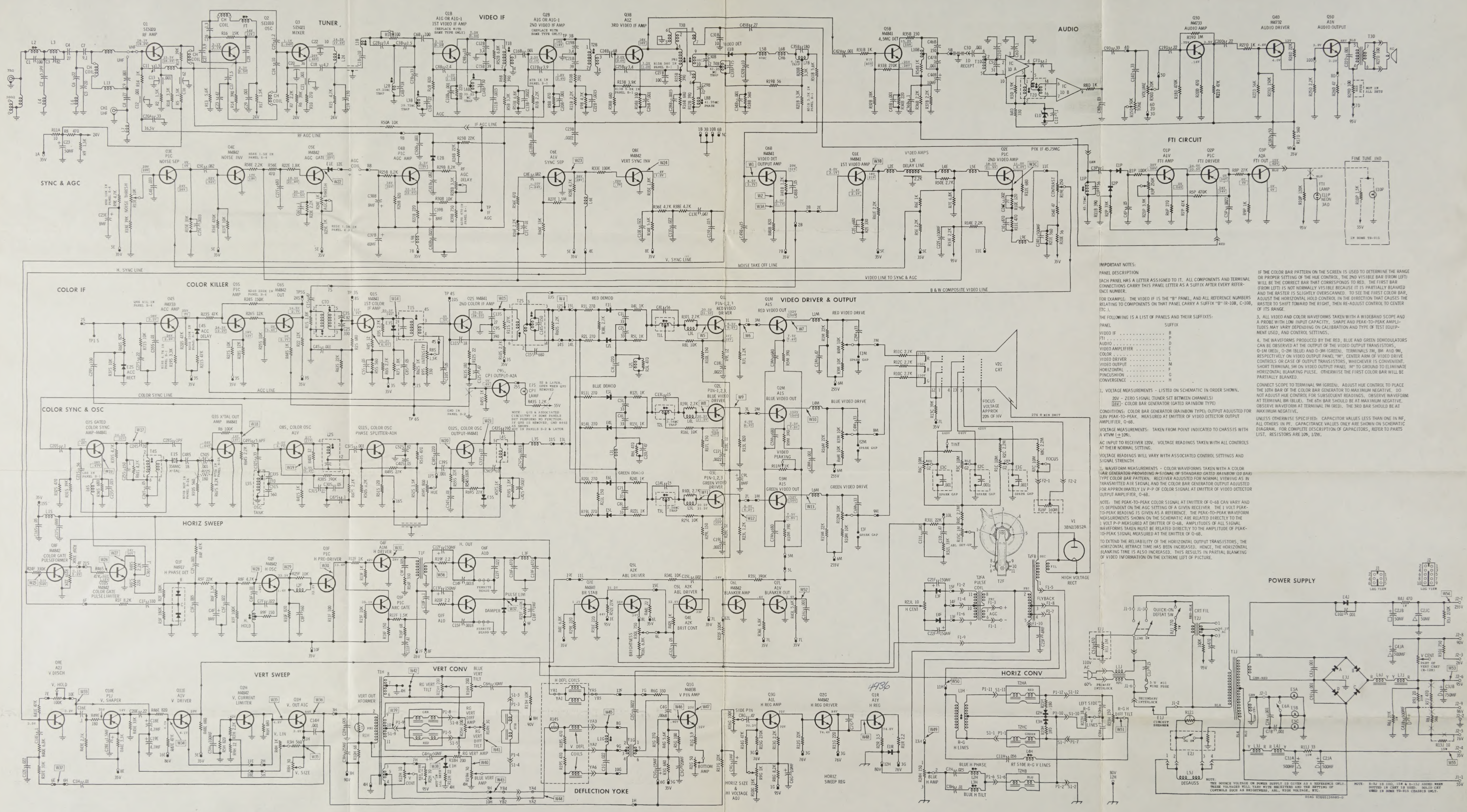
NOTE: If a shield exists between video IF panel "B" and video amp. panel "E" it will be necessary to remove this shield. First, remove panel "E." Then, loosen two (2) bottom shield grounding screws at rear of panel "B." Also remove 2 screws from the top of this shield.

2. 23TS-919 only—Remove shield on bottom of cabinet, then, remove three (3) panel grounding screws and panel shield grounding clip on bottom of panel.
3. 20TS-919 — Slide chassis to service position, remove (3) panel grounding screws and grounding clip. — See label on bottom of panel.

NOTE: If a shield exists between video IF panel "B" and video amp. panel "E," remove the two (2) shield grounding screws.

4. Disconnect blue lead and white wire feeding VHF tuner.
5. Unplug tuner cable from panel.
6. Remove one (1) shield retaining screw from panel on top of panel "B" and remove shield. Lift panel and shield off IF shield and disconnect green lead and red B+ lead from IF panel.
7. INSTALLATION: The replacement panel is equipped with two (2) B+ lugs. One is located under the IF shield (RF choke in some panels), and is used for the FTL or AFC panel. The other is located outside of the IF shield near capacitor C-37B; it is identified as +35V, and is used for the F.T.I. panel. This lug (bullet head type in some sets—white wire to VHF tuner) formerly located adjacent to the RF AGC delay control, is now located near capacitor C-37B.

SHEET 68P65140A38-B-GI



IMPORTANT NOTES:

PANEL DESCRIPTION

EACH PANEL HAS A LETTER ASSIGNED TO IT. ALL COMPONENTS AND TERMINAL CONNECTIONS CARRY THIS PANEL LETTER AS A SUFFIX AFTER EVERY REFERENCE NUMBER.

FOR EXAMPLE: THE VIDEO IF IS THE "B" PANEL, AND ALL REFERENCE NUMBERS RELATING TO COMPONENTS ON THAT PANEL CARRY A SUFFIX "B" (R-10B, C-10B, ETC.).

THE FOLLOWING IS A LIST OF PANELS AND THEIR SUFFIXES:

PANEL	SUFFIX
VIDEO IF	B
FTI	P
AUDIO	D
VIDEO AMPLIFIER	E
COLOR	S
VIDEO DRIVER	L
VIDEO OUTPUT	M
HORIZONTAL	F
PINCUSHION	G
CONVERGENCE	H

1. VOLTAGE MEASUREMENTS - LISTED ON SCHEMATIC IN ORDER SHOWN.

20V - ZERO SIGNAL (TUNER SET BETWEEN CHANNELS)
16V - COLOR BAR GENERATOR (GATED RAINBOW TYPE)

CONDITIONS: COLOR BAR GENERATOR (RAINBOW TYPE); OUTPUT ADJUSTED FOR 0.8V PEAK-TO-PEAK. MEASURED AT EMITTER OF VIDEO DETECTOR OUTPUT AMPLIFIER, Q-6B.

VOLTAGE MEASUREMENTS: TAKEN FROM POINT INDICATED TO CHASSIS WITH A VTVM (±10%).

AC INPUT TO RECEIVER 120V. VOLTAGE READINGS TAKEN WITH ALL CONTROLS AT THEIR NORMAL SETTING.

VOLTAGE READINGS WILL VARY WITH ASSOCIATED CONTROL SETTINGS AND SIGNAL STRENGTH.

2. WAVEFORM MEASUREMENTS - COLOR WAVEFORMS TAKEN WITH A COLOR BAR GENERATOR PROVIDING A SIGNAL OF STANDARD GATED RAINBOW (10 BAR) TYPE COLOR BAR PATTERN. RECEIVER ADJUSTED FOR NORMAL VIEWING AS IN TRANSMITTED AIR SIGNAL AND THE COLOR BAR GENERATOR OUTPUT ADJUSTED FOR APPROXIMATELY 1V P-P OF COLOR SIGNAL AT EMITTER OF VIDEO DETECTOR OUTPUT AMPLIFIER, Q-6B.

NOTE: THE PEAK-TO-PEAK COLOR SIGNAL AT EMITTER OF Q-6B CAN VARY AND IS DEPENDENT ON THE AGC SETTING OF A GIVEN RECEIVER. THE 1 VOLT PEAK-TO-PEAK READING IS GIVEN AS A REFERENCE. THE PEAK-TO-PEAK WAVEFORM MEASUREMENTS SHOWN ON THE SCHEMATIC ARE RELATED DIRECTLY TO THE 1 VOLT P-P MEASURED AT EMITTER OF Q-6B. AMPLITUDES OF ALL SIGNAL WAVEFORMS TAKEN MUST BE RELATED DIRECTLY TO THE AMPLITUDE OF PEAK-TO-PEAK SIGNAL MEASURED AT THE EMITTER OF Q-6B.

TO EXTEND THE RELIABILITY OF THE HORIZONTAL OUTPUT TRANSISTORS, THE HORIZONTAL RETRACE TIME HAS BEEN INCREASED. HENCE, THE HORIZONTAL BLANKING TIME IS ALSO INCREASED. THIS RESULTS IN PARTIAL BLANKING OF VIDEO INFORMATION ON THE EXTREME LEFT OF PICTURE.

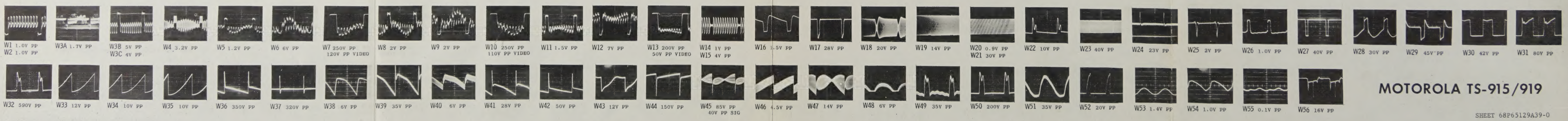
IF THE COLOR BAR PATTERN ON THE SCREEN IS USED TO DETERMINE THE RANGE OR PROPER SETTING OF THE HUE CONTROL, THE 2ND VISIBLE BAR (FROM LEFT) WILL BE THE CORRECT BAR THAT CORRESPONDS TO RED. THE FIRST BAR (FROM LEFT) IS NOT NORMALLY VISIBLE BECAUSE IT IS PARTIALLY BLANKED AND THE RASTER IS SLIGHTLY OVERSCANNED. TO SEE THE FIRST COLOR BAR, ADJUST THE HORIZONTAL HOLD CONTROL IN THE DIRECTION THAT CAUSES THE RASTER TO SHIFT TOWARD THE RIGHT, THEN RE-ADJUST CONTROL TO CENTER OF ITS RANGE.

3. ALL VIDEO AND COLOR WAVEFORMS TAKEN WITH A WIDEBAND SCOPE AND A PROBE WITH LOW INPUT CAPACITY. SHAPE AND PEAK-TO-PEAK AMPLITUDES MAY VARY DEPENDING ON CALIBRATION AND TYPE OF TEST EQUIPMENT USED, AND CONTROL SETTINGS.

4. THE WAVEFORMS PRODUCED BY THE RED, BLUE AND GREEN DEMODULATORS CAN BE OBSERVED AT THE OUTPUT OF THE VIDEO OUTPUT TRANSISTORS, Q-1M (RED), Q-2M (BLUE) AND Q-3M (GREEN). TERMINALS 7M, 8M AND 9M, RESPECTIVELY ON VIDEO OUTPUT PANEL "M", CENTER ARM OF VIDEO DRIVE CONTROLS OR CASE OF OUTPUT TRANSISTORS, WHICHEVER IS CONVENIENT. SHORT TERMINAL 5M ON VIDEO OUTPUT PANEL "M" TO GROUND TO ELIMINATE HORIZONTAL BLANKING PULSE. OTHERWISE THE FIRST COLOR BAR WILL BE PARTIALLY BLANKED.

CONNECT SCOPE TO TERMINAL 9M (GREEN). ADJUST HUE CONTROL TO PLACE THE 10TH BAR OF THE COLOR BAR GENERATOR TO MAXIMUM NEGATIVE. DO NOT ADJUST HUE CONTROL FOR SUBSEQUENT READINGS. OBSERVE WAVEFORM AT TERMINAL 8M (BLUE). THE 6TH BAR SHOULD BE AT MAXIMUM NEGATIVE. OBSERVE WAVEFORM AT TERMINAL 7M (RED). THE 3RD BAR SHOULD BE AT MAXIMUM NEGATIVE.

UNLESS OTHERWISE SPECIFIED: CAPACITOR VALUES LESS THAN ONE IN MF, ALL OTHERS IN PF. CAPACITANCE VALUES ONLY ARE SHOWN ON SCHEMATIC DIAGRAM. FOR COMPLETE DESCRIPTION OF CAPACITORS, REFER TO PARTS LIST. RESISTORS ARE 10%, 1/2W.



MOTOROLA TS-915/919

SHEET 68P65129A39-0

SUPPLEMENT NO. 2
TO TS-594 SERVICE MANUAL,
PART NO. 68P65135A58

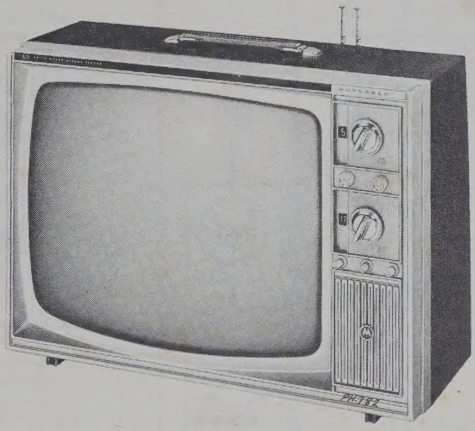
television **MANUAL 68P65135A60**

CHASSIS JTS-594

MODEL BT601CH/TR821 AMPEX

MOTOROLA

service manual



MODEL BT601CH/TR821 AMPEX

television MANUAL 68P65135A60
CHASSIS JTS-594
MODEL BT601CH/TR821 AMPEX

GENERAL INFORMATION

This supplement includes servicing information, schematic diagram and parts list for the modifications made by Ampex to the JTS-594 chassis for use as a TV receiver/video tape monitor, Ampex Model TR821-01 and -02.

The Consumer and Educational Products Division of Ampex Corporation selected Motorola's BT601CH receiver as a video monitor for use with their video tape recording equipment. While Ampex is modifying it slightly to accommodate external video input, a video output, etc., the basic chassis will remain the same with all Motorola identification intact. Ampex will add a control panel and an internal subchassis and will designate the unit a TR821 receiver/monitor.

The block diagram of the modified TS-594 chassis and Ampex subchassis shows that the video information coupled to the video output and sync circuits can be selected from either the TS-594 video amplifier or the video tape recorder.

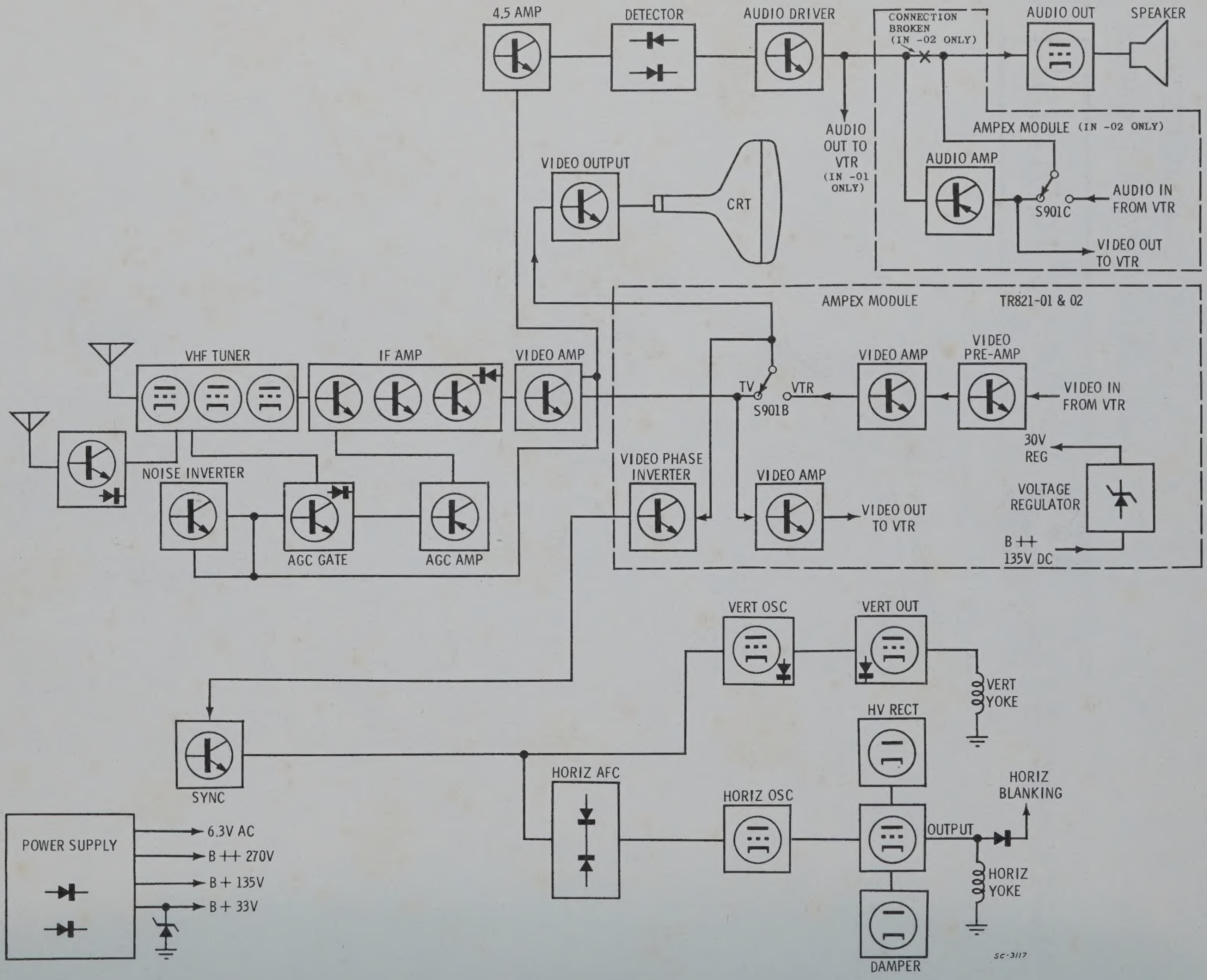
The TR821-01 and -02 schematic shows the circuits that are modified and the circuits that are added by Ampex.

SUPPLEMENT NO. 2
TO TS-594 SERVICE MANUAL,
PART NO. 68P65135A58

MODEL BREAKDOWN CHART

MODEL	CHASSIS	VHF TUNER	UHF TUNER	CRT
BT601CH	JTS-594	OPTT-396 or OPTT-404	HTT-624 or HTT-627	21FZP4

MOTOROLA INC. 9401 WEST GRAND AVENUE, FRANKLIN PARK, ILLINOIS
PART NO. 68P65135A60 3-67 PRICE 20 CENTS COPYRIGHT 1967 BY MOTOROLA INC. - PRINTED IN U.S.A.


4.5 AMP
DETECTOR
AUDIO DRIVER
CONNECTION BROKEN (IN -02 ONLY)
AUDIO OUT
SPEAKER
AUDIO OUT TO VTR (IN -01 ONLY)
AMPEX MODULE (IN -02 ONLY)
AUDIO AMP
S901C
AUDIO IN FROM VTR
VIDEO OUT TO VTR
VIDEO OUTPUT
CRT
AMPEX MODULE
TR821-01 & 02
VHF TUNER
IF AMP
VIDEO AMP
TV
VTR
S901B
VIDEO AMP
VIDEO PRE-AMP
VIDEO IN FROM VTR
30V REG
NOISE INVERTER
AGC GATE
AGC AMP
VIDEO PHASE INVERTER
VIDEO AMP
VIDEO OUT TO VTR
VOLTAGE REGULATOR
B ++ 135V DC
VERT OSC
VERT OUT
VERT YOKE
HV RECT
SYNC
HORIZ AFC
HORIZ OSC
OUTPUT
HORIZ BLANKING
HORIZ YOKE
DAMPER
POWER SUPPLY
6.3V AC
B ++ 270V
B + 135V
B + 33V
SC-3117

COMPLETE BLOCK DIAGRAM

REPLACEMENT PARTS LIST

The following parts list is for your information only. Parts from this list should be ordered from Ampex Factory Parts, Consumer Products Division, 2201 Lunt Ave, Elk Grove Village, Illinois 60007.

Ref. No.	Part Number	Description
	7056252-01	P.C. BOARD, (Inc. all components - -02 only)
	7506047-01	P.C. BOARD, (Less all components - -02 only)
	7506043-01	P.C. BOARD, (Less all components - -01 only)
	7056213-01	P.C. BOARD, (Inc all components - -01 only)
Q-901	7576015-01	TRANSISTOR
Q-902	014-694	TRANSISTOR, 2N3568
Q-903	014-694	TRANSISTOR, 2N3568
Q-904	014-654	TRANSISTOR, 2N3646
Q-905	7576004-01	TRANSISTOR, 2N3638A (-02 only)
C-901	031-817	ELECTROLYTIC, 500mfd 50V
C-902	031-271	ELECTROLYTIC, 100mfd 15V
C-903	031-816	ELECTROLYTIC, 50mfd 25V
C-904	4555000-01	ELECTROLYTIC, 500mfd 35V
C-905	031-186	ELECTROLYTIC, 100mfd 25V
C-906	031-246	ELECTROLYTIC, 50mfd 15V
C-907	034-939	MICA, 91pfd 500V
C-908	031-271	ELECTROLYTIC, 100mfd 15V (-02 only)
C-909	055-211	.0047mfd 100V (-02 only)
C-910	055-219	.22mfd 75V (-02 only)
C-911	055-219	.22mfd 75V (-02 only)
CR-901	013-768	DIODE, Zener 1N4751
R-901	059-076	Wirewound, 1.5K ohm 15W 10%
R-902	041-043	390 ohm 10% 1/2W
R-903	041-052	2.2K ohm 10% 1/2W
R-904	041-051	1.8K ohm 10% 1/2W
R-905	041-060	10K ohm 10% 1/2W
R-906	041-040	220 ohm 10% 1/2W
R-907	041-051	1.8K ohm 10% 1/2W
R-908	041-054	3.3K ohm 10% 1/2W
R-909	041-146	1K ohm 10% 1W
R-910	041-072	100K ohm 10% 1/2W
R-911	041-048	1K ohm 10% 1/2W
R-912	041-057	5.6K ohm 10% 1/2W
R-913	041-051	1.8K ohm 10% 1/2W
R-914	041-065	27K ohm 10% 1/2W
R-915	041-055	3.9K ohm 10% 1/2W
R-916	041-046	680 ohm 10% 1/2W
R-917	041-048	1K ohm 10% 1/2W
R-918	041-516	75 ohm 5% 1/2W

Ref. No.	Part Number	Description
R-919	041-072	100K ohm 10% 1/2W (-02 only)
	041-076	220K ohm 10% 1/2W (-01 only)
R-920	041-074	150K ohm 10% 1/2W (-02 only)
	041-060	10K ohm 10% 1/2W (-01 only)
R-921	041-053	2.7K ohm 10% 1/2W (-02 only)
R-922	041-038	100 ohm 10% 1/2W (-02 only)
R-923	041-058	6.8K ohm 10% 1/2W (-02 only)
R-924	041-072	100K ohm 10% 1/2W (-02 only)

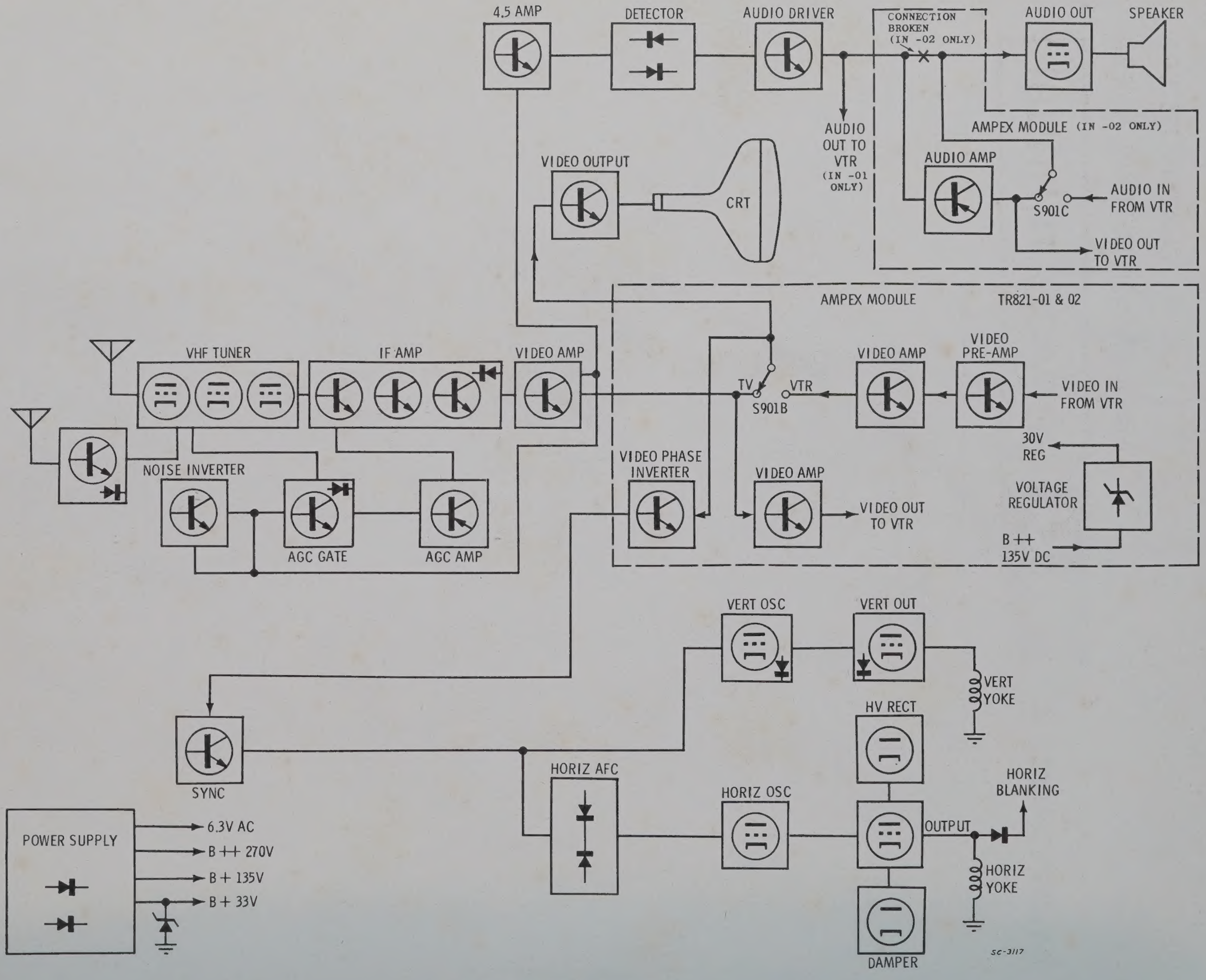
On chassis TS-594C-04 and earlier C-503 is changed (by Ampex) to a .047 mfd 200V capacitor to provide faster AFC tuning. Chassis C-05 and later incorporate this change from the factory, Motorola Part Number 8S10169B19.

MISCELLANEOUS ELECTRICAL

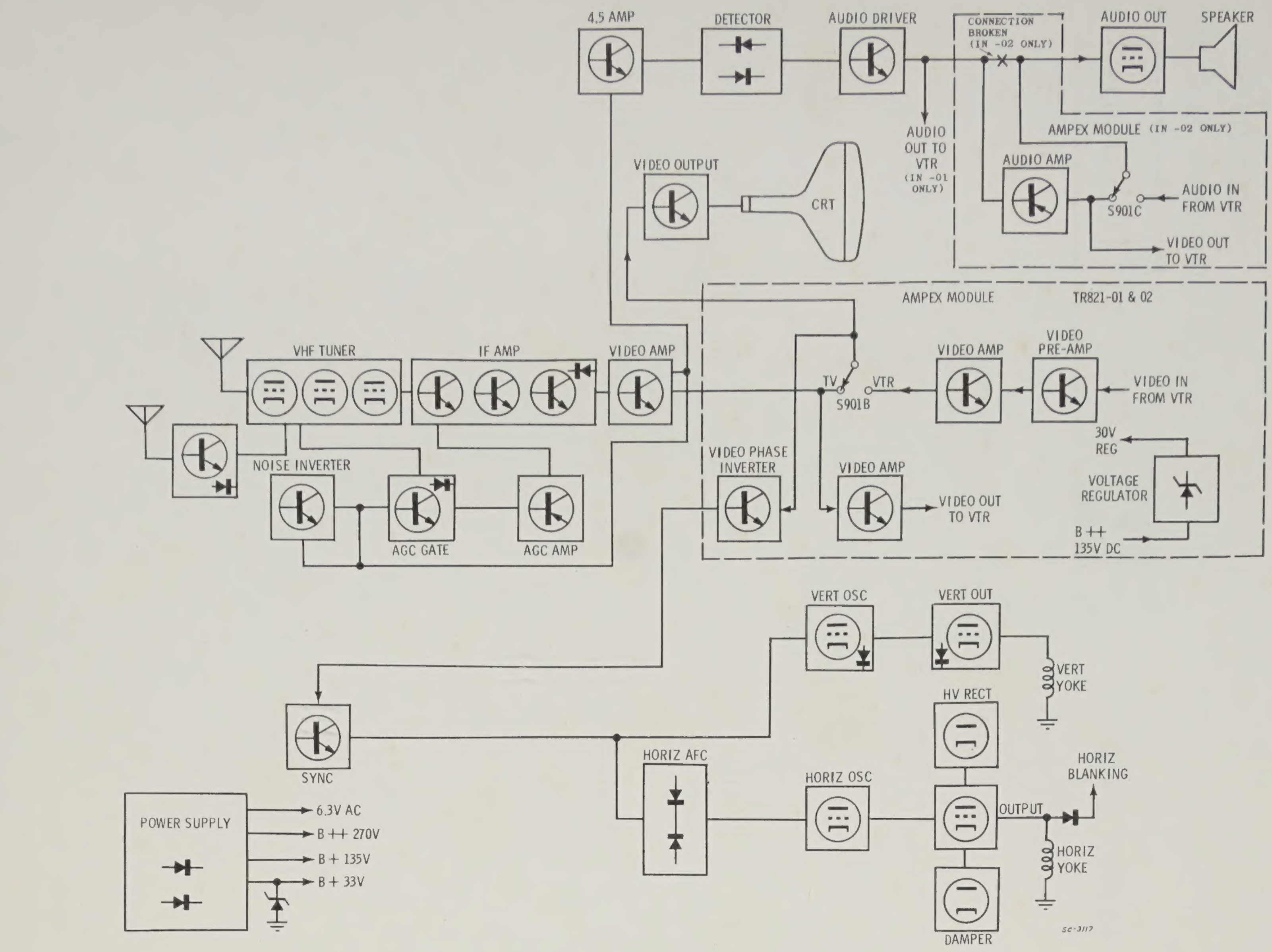
Ref. No.	Part Number	Description
J-901	142-026	CONNECTOR, BNC (Video in)
J-902	142-026	CONNECTOR, BNC (Audio in - Video in on -01)
J-903	142-026	CONNECTOR, BNC (Video out)
J-904	148-015	JACK, Phone (Audio out)
J-905	143-286	CONNECTOR, edge (12 pin)
S-901	7626020-01	SWITCH, function (-01 only)
	7626024-01	SWITCH, function (-02 only)
S-902	7626023-01	SWITCH, impedance
	7660000-29	TERMINAL, strip (-02 only)
	7660001-11	TERMINAL, strip
	7106003-01	KNOB
	302-370	CLAMP, cable

MISCELLANEOUS HARDWARE

Ref. No.	Part Number	Description
	7046152-01	BRACKET AND STUD ASSEM, PC board mtg
	7266113-01	BRACKET, monitor modification (-01 only)
	7266128-01	BRACKET, monitor modification (-02 only)
	475-108	SCREW, mach #8-32 x 1/4
	475-081	SCREW, mach #6-32 x 1/4
	476-039	SCREW, mach #6A x 3/8
	173-509	LUG, BNC ground
	492-049	NUT, #3/8 x 32
	503-006	FLAT WASHER, fibre
	503-029	SHOULDER WASHER, fibre
	471-336	SCREW, mach #6-32 x 3/8
	496-005	NUT, #6-32


4.5 AMP
DETECTOR
AUDIO DRIVER
CONNECTION BROKEN (IN -02 ONLY)
AUDIO OUT
SPEAKER
AUDIO OUT TO VTR (IN -01 ONLY)
AMPEX MODULE (IN -02 ONLY)
AUDIO AMP
S901C
AUDIO IN FROM VTR
VIDEO OUT TO VTR
VIDEO OUTPUT
CRT
AMPEX MODULE
TR821-01 & 02
VHF TUNER
IF AMP
VIDEO AMP
TV
VTR
S901B
VIDEO AMP
VIDEO PRE-AMP
VIDEO IN FROM VTR
30V REG
VOLTAGE REGULATOR
B ++ 135V DC
NOISE INVERTER
AGC GATE
AGC AMP
VIDEO PHASE INVERTER
VIDEO AMP
VIDEO OUT TO VTR
VERT OSC
VERT OUT
VERT YOKE
HV RECT
SYNC
HORIZ AFC
HORIZ OSC
OUTPUT
HORIZ BLANKING
HORIZ YOKE
DAMPER
POWER SUPPLY
6.3V AC
B ++ 270V
B + 135V
B + 33V
SC-3117

COMPLETE BLOCK DIAGRAM


4.5 AMP
DETECTOR
AUDIO DRIVER
CONNECTION BROKEN (IN -02 ONLY)
AUDIO OUT
SPEAKER
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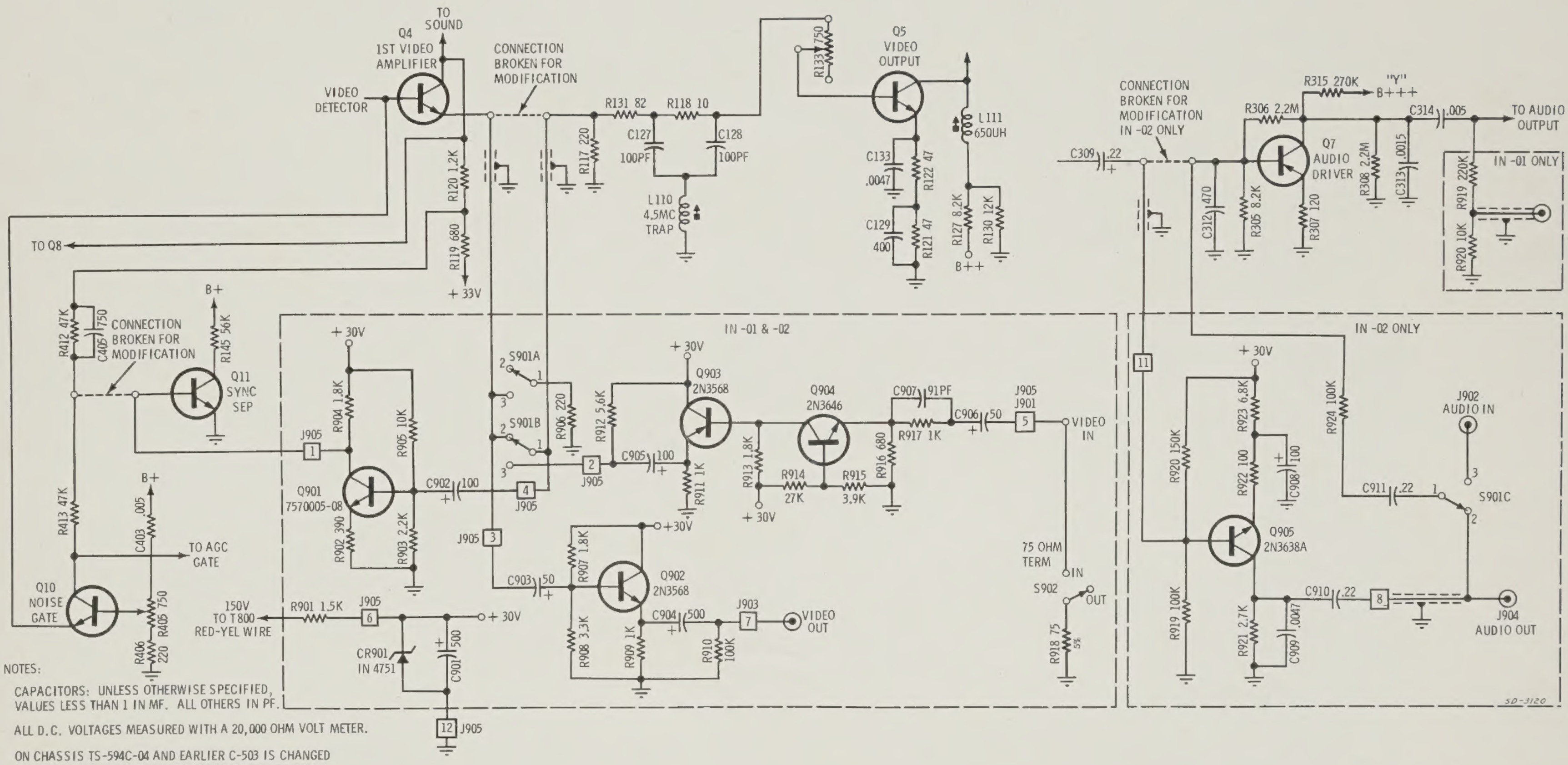
VIDEO IN FROM VTR
NOISE INVERTER
AGC GATE
AGC AMP
VIDEO PHASE INVERTER
VIDEO AMP
VIDEO OUT TO VTR
30V REG
VOLTAGE REGULATOR
B++ 135V DC
VERT OSC
VERT OUT
VERT YOKE
SYNC
HV RECT
HORIZ AFC
HORIZ OSC
OUTPUT
HORIZ BLANKING
HORIZ YOKE
DAMPER
POWER SUPPLY
6.3V AC
B++ 270V
B+ 135V
B+ 33V
2C-3117

COMPLETE BLOCK DIAGRAM


TO SOUND
Q4 1ST VIDEO AMPLIFIER
VIDEO DETECTOR
CONNECTION BROKEN FOR MODIFICATION
R131 82
R118 10
C127 100PF
C128 100PF
L110 4.5MC TRAP
R117 220
R120 1.2K
R119 680
+33V
R133 750
Q5 VIDEO OUTPUT
L111 650UH
C133 .0047
R122 47
C129 400
R121 47
R127 8.2K
R130 12K
B++
CONNECTION BROKEN FOR MODIFICATION IN -02 ONLY
C309 .22
R306 2.2M
R315 270K
"Y"
B+++
Q7 AUDIO DRIVER
C312 470
R305 8.2K
R307 120
R308 2.2M
C313 .0015
C314 .005
TO AUDIO OUTPUT
IN -01 ONLY
R919 220K
R920 10K
TO Q8
R412 47K
C405 750
CONNECTION BROKEN FOR MODIFICATION
B+
R145 56K
Q11 SYNC SEP
R413 47K
C403 .005
TO AGC GATE
Q10 NOISE GATE
R405 750
R406 220
IN -01 & -02
+30V
R904 1.8K
R905 10K
J905
Q901 7570005-08
R902 390
R903 2.2K
C902 100
S901A
S901B
R906 220
R912 5.6K
C905 100
Q903 2N3568
R911 1K
R913 1.8K
R914 27K
R915 3.9K
Q904 2N3646
R916 680
C907 91PF
R917 1K
C906 50
J901
VIDEO IN
Q902 2N3568
R907 1.8K
R908 3.3K
R909 1K
C904 500
R910 100K
J903
VIDEO OUT
C903 50
150V TO T800 RED-YEL WIRE
R901 1.5K
CR901 IN 4751
C901 500
75 OHM TERM
S902
IN
OUT
R918 75
IN -02 ONLY
R923 6.8K
R922 100
C908 100
R924 100K
J902 AUDIO IN
S901C
C911 .22
R920 150K
Q905 2N3638A
R919 100K
R921 2.7K
C909 .0047
C910 .22
J904 AUDIO OUT
3D-3120

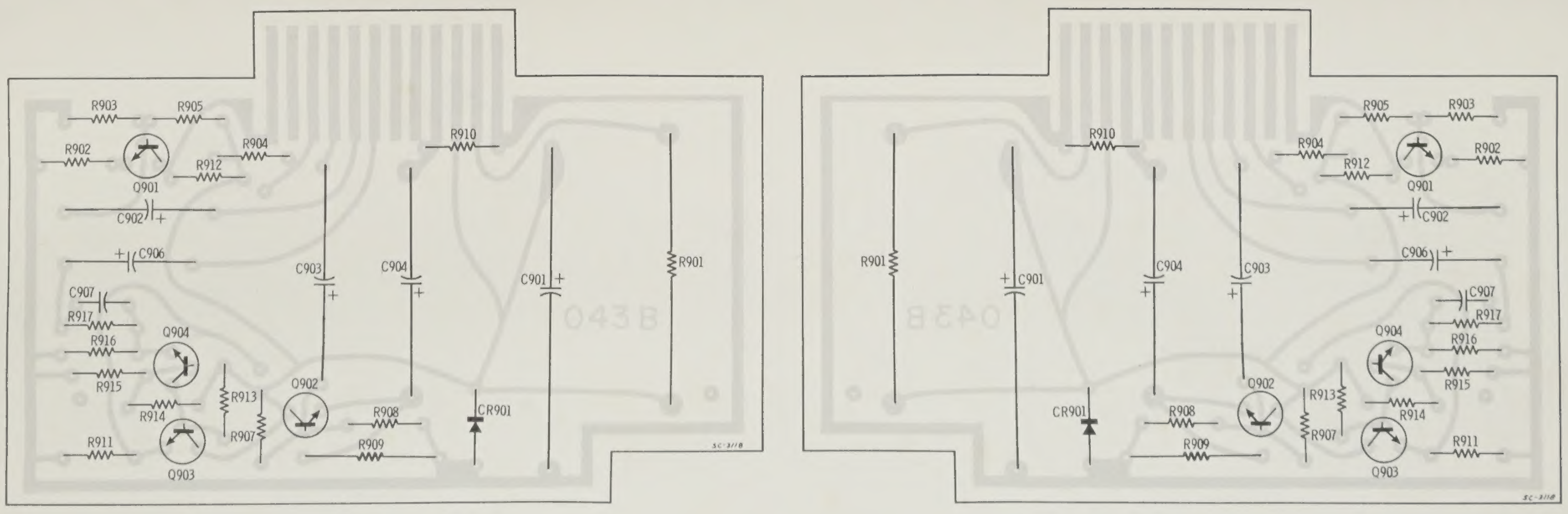
NOTES:

CAPACITORS: UNLESS OTHERWISE SPECIFIED, VALUES LESS THAN 1 IN MF. ALL OTHERS IN PF.

ALL D.C. VOLTAGES MEASURED WITH A 20,000 OHM VOLT METER.

ON CHASSIS TS-594C-04 AND EARLIER C-503 IS CHANGED (BY AMPEX) TO A .047 MFD 200V CAPACITOR TO PROVIDE FASTER AFC TUNING. CHASSIS C-05 AND LATER INCORPORATE THIS CHANGE FROM THE FACTORY, MOTOROLA PART NUMBER 8S10169B19.

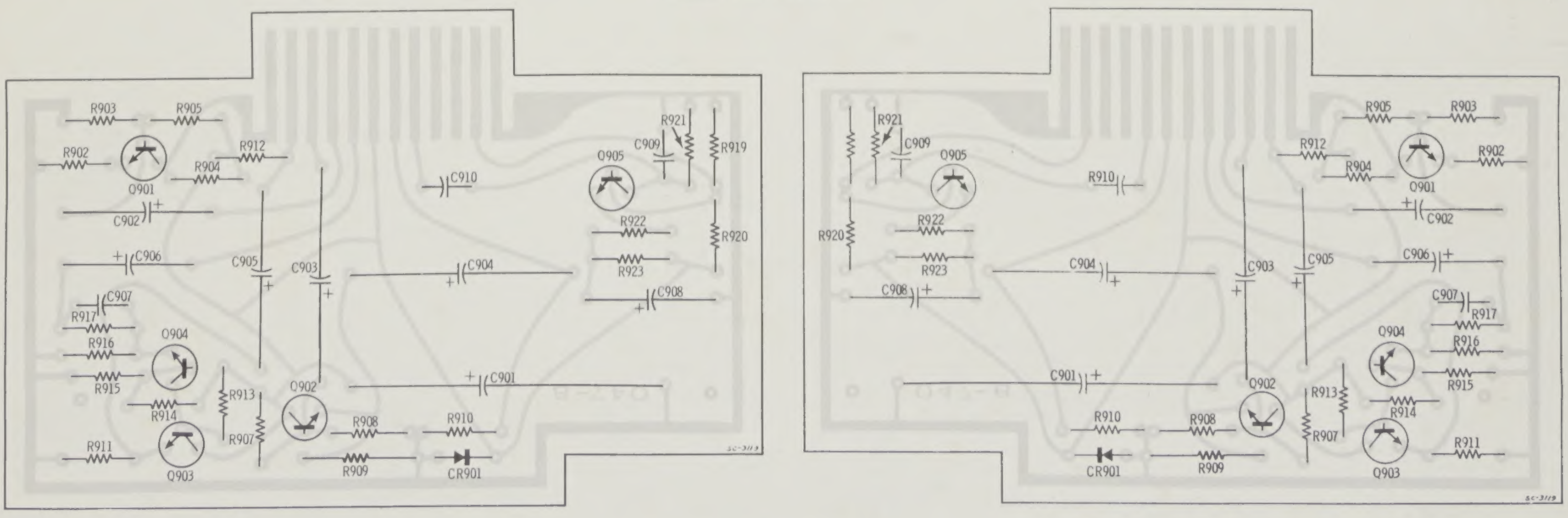
TR821-01 & -02 SCHEMATIC DIAGRAM


R903
R905
R902
Q901
R912
R904
C902
C906
C907
R917
R916
R915
Q904
R914
R911
Q903
R913
R907
Q902
R908
R909
C903
C904
C901
R910
R901
CR901
043B

TOP VIEW

BOTTOM VIEW

TR821-01 PARTS LOCATION


R903
R905
R902
Q901
R904
R912
C902
C906
C905
C903
C907
R917
R916
R915
Q904
R914
R911
Q903
R913
R907
Q902
R908
R909
R910
CR901
C901
C904
C910
Q905
C909
R921
R919
R920
R922
R923
C908

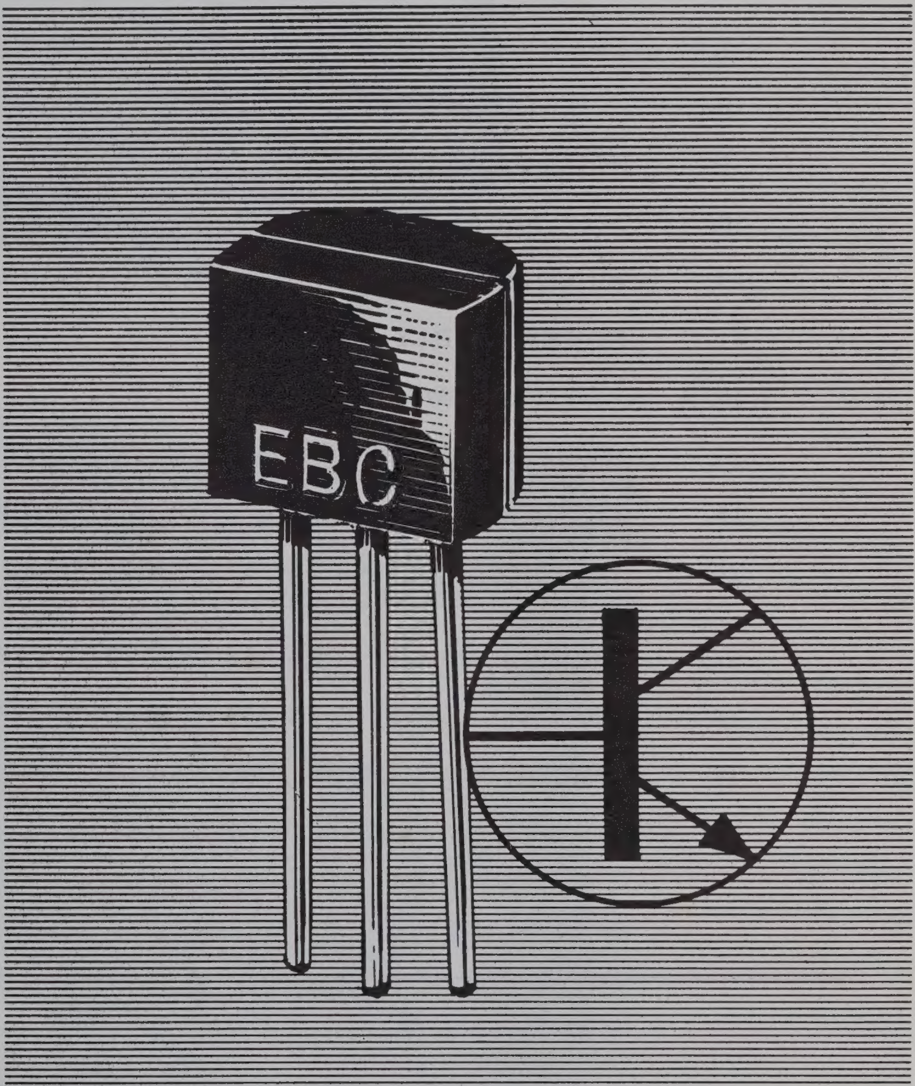
TOP VIEW

BOTTOM VIEW

TR821-02 PARTS LOCATION

MOTOROLA

SOLID STATE B-W TELEVISION



TS-458 CHASSIS

MOTOROLA PRODUCT TECHNICAL TRAINING

Part No. 68P65139A10-3 Price 50 Cents Printed in U.S.A.

INDEX

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3. TRANSISTOR BASE DIAGRAMS 6
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5. VIDEO IF CIRCUITS 8
6. VIDEO AMPLIFIER AND OUTPUT CIRCUITS 12
7. CRT CRICUITRY 14
8. AGC SYSTEM 14
9. NOISE GATE CIRCUIT 18
10. SYNC SEPARATOR CIRCUIT 19
11. AUDIO IF, ALIGNMENT AND OUTPUT CIRCUITS 20
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13. VERTICAL SWEEP SYSTEM 22
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MOTOROLA PRODUCT TECHNICAL TRAINING

PREPARED BY

THE NATIONAL SERVICE DEPARTMENT

MOTOROLA CONSUMER PRODUCTS, INC. - FRANKLIN PARK, ILLINOIS

INTRODUCTION TO TS-458

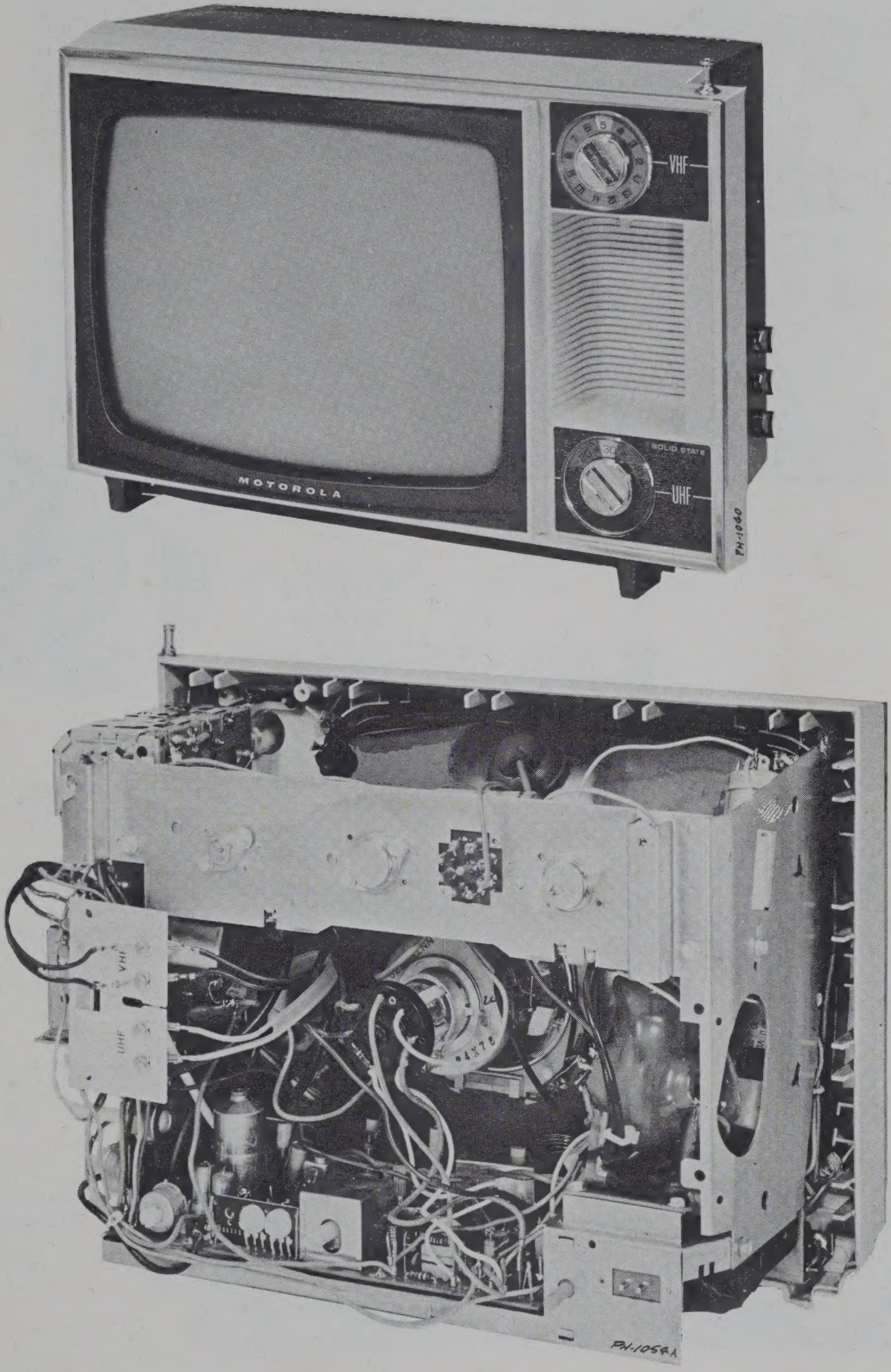

VHF
MOTOROLA
SOLID STATE
UHF
PH-1060
VHF
UHF
PH-1059A

FIGURE 1 - TS-458 CHASSIS

The TS-458 is a new solid state chassis being introduced into the Motorola portable line.

Figure #1 shows a rear view of the chassis with the back covered removed. It can readily be seen that nearly every component is accessible simply by removing the back cover of the receiver.

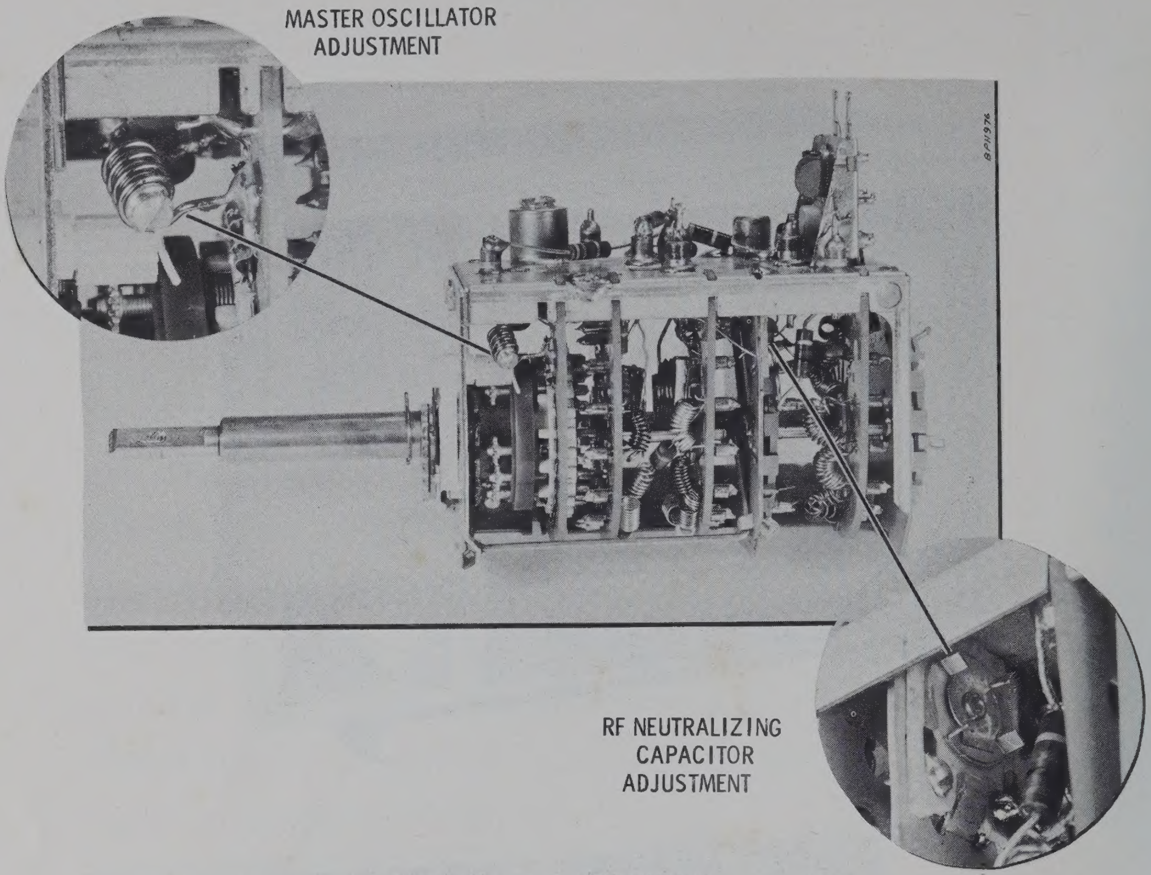

MASTER OSCILLATOR
ADJUSTMENT
BPH976
RF NEUTRALIZING
CAPACITOR
ADJUSTMENT

FIGURE 2 - TT-394 TUNER

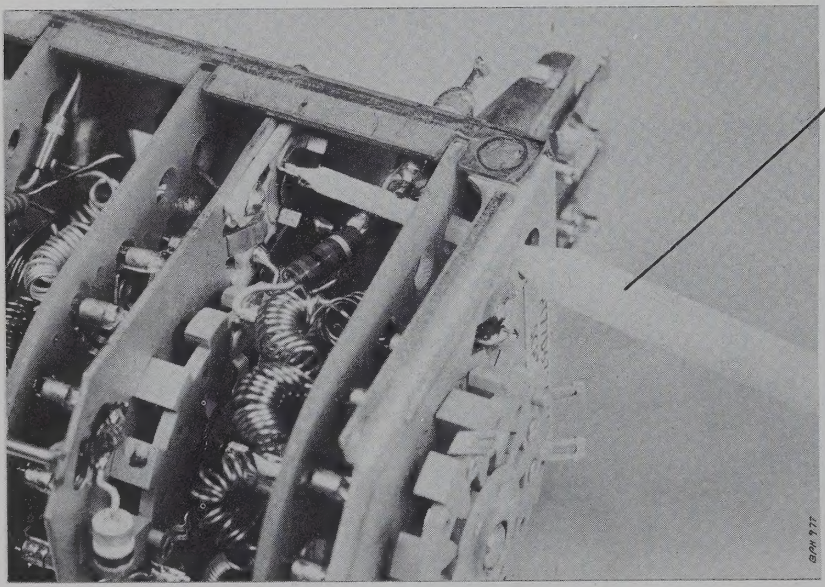

USE INSULATED TOOL
TO ADJUST RF
NEUTRALIZING CAPACITOR
AS SHOWN.
BPH 977

FIGURE 3 - TT-394 NEUTRALIZING

The TT-394 tuner is a four circuit switch type VHF tuner, utilizing a concentric pre-set fine tuning. Shown in Figure #2 is a portion of the VHF tuner with close-up views of the master oscillator and RF neutralizing adjustments. Adjustment of the RF neutralizing capacitor can be performed from the rear of the tuner with an insulated tool as shown in Figure #3. This adjustment will be discussed shortly.

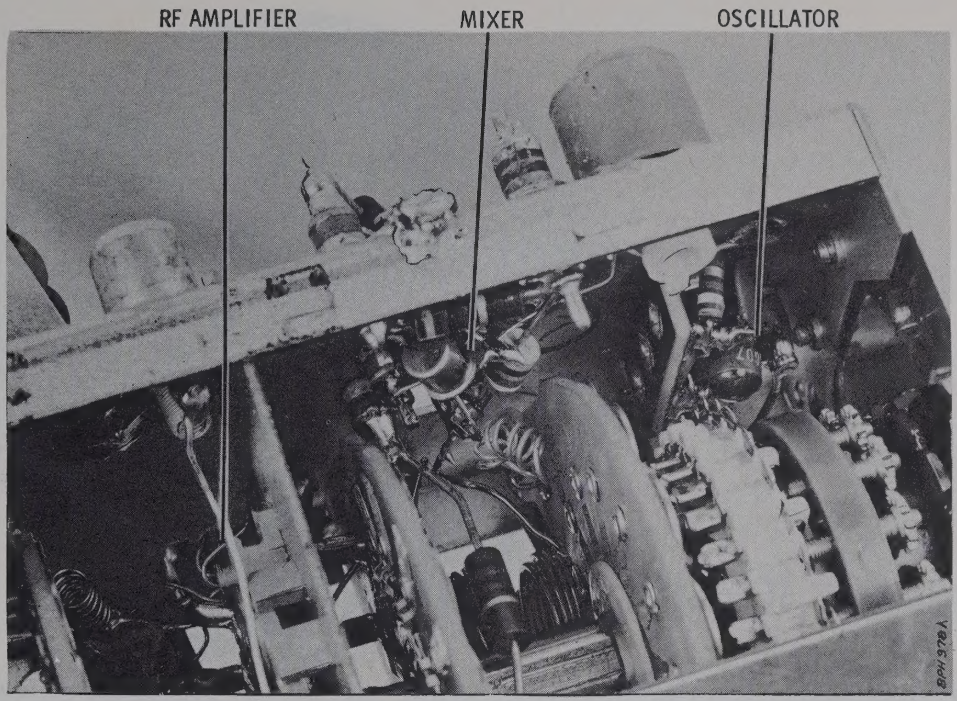

RF AMPLIFIER
MIXER
OSCILLATOR
BPH 976 A

FIGURE 4 - TT-394 TRANSISTOR LOCATION

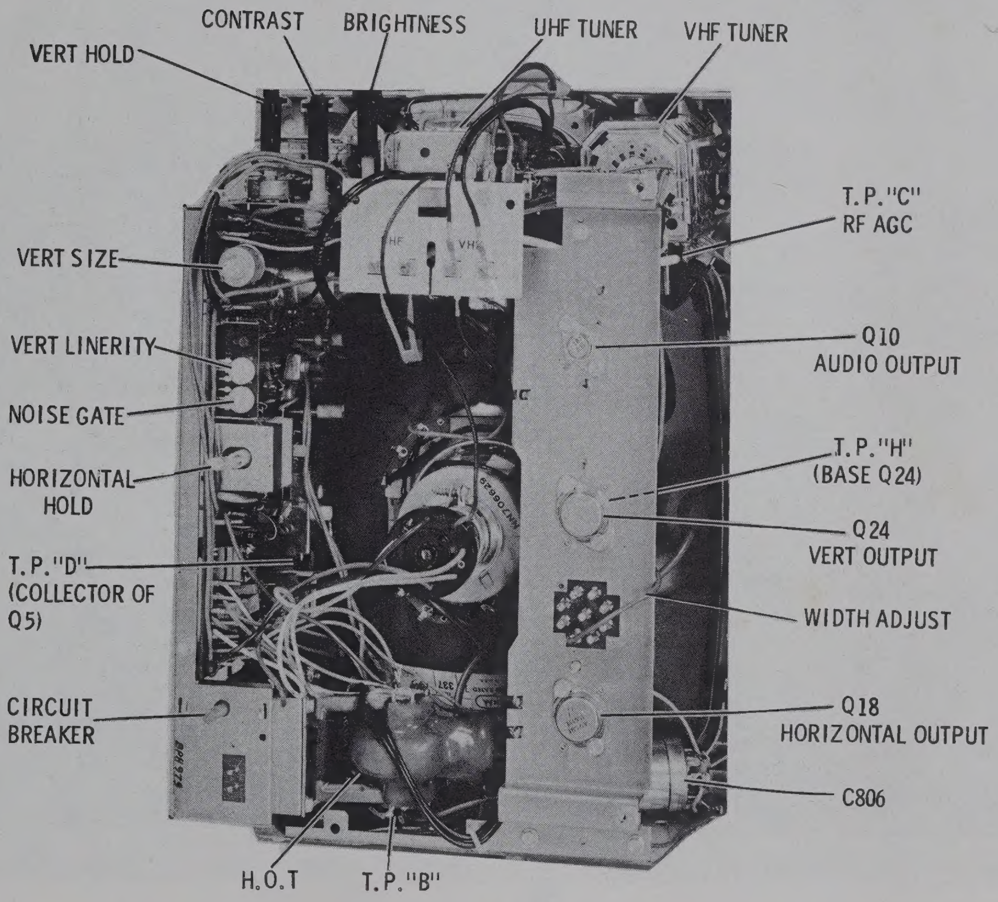

CONTRAST
BRIGHTNESS
UHF TUNER
VHF TUNER
VERT HOLD
T.P."C"
RF AGC
VERT SIZE
Q10
AUDIO OUTPUT
VERT LINERITY
NOISE GATE
T.P."H"
(BASE Q24)
HORIZONTAL
HOLD
Q24
VERT OUTPUT
T.P."D"
(COLLECTOR OF
Q5)
WIDTH ADJUST
CIRCUIT
BREAKER
Q18
HORIZONTAL OUTPUT
C806
H.O.T
T.P."B"

FIGURE 5 - TS-458 CHASSIS - EXPOSED FOR TROUBLESHOOTING

With the tuner cover removed, Figure #4 shows the location of the RF amplifier, mixer, and oscillator transistors.

For troubleshooting the TS-458, all test points and components are accessible when the back cover is removed and the chassis resting on its side (see Figure #5).

To provide an easy means of circuit tracing, the TS-458 has a circuit and component legend on both the top and bottom sides of the etched board.

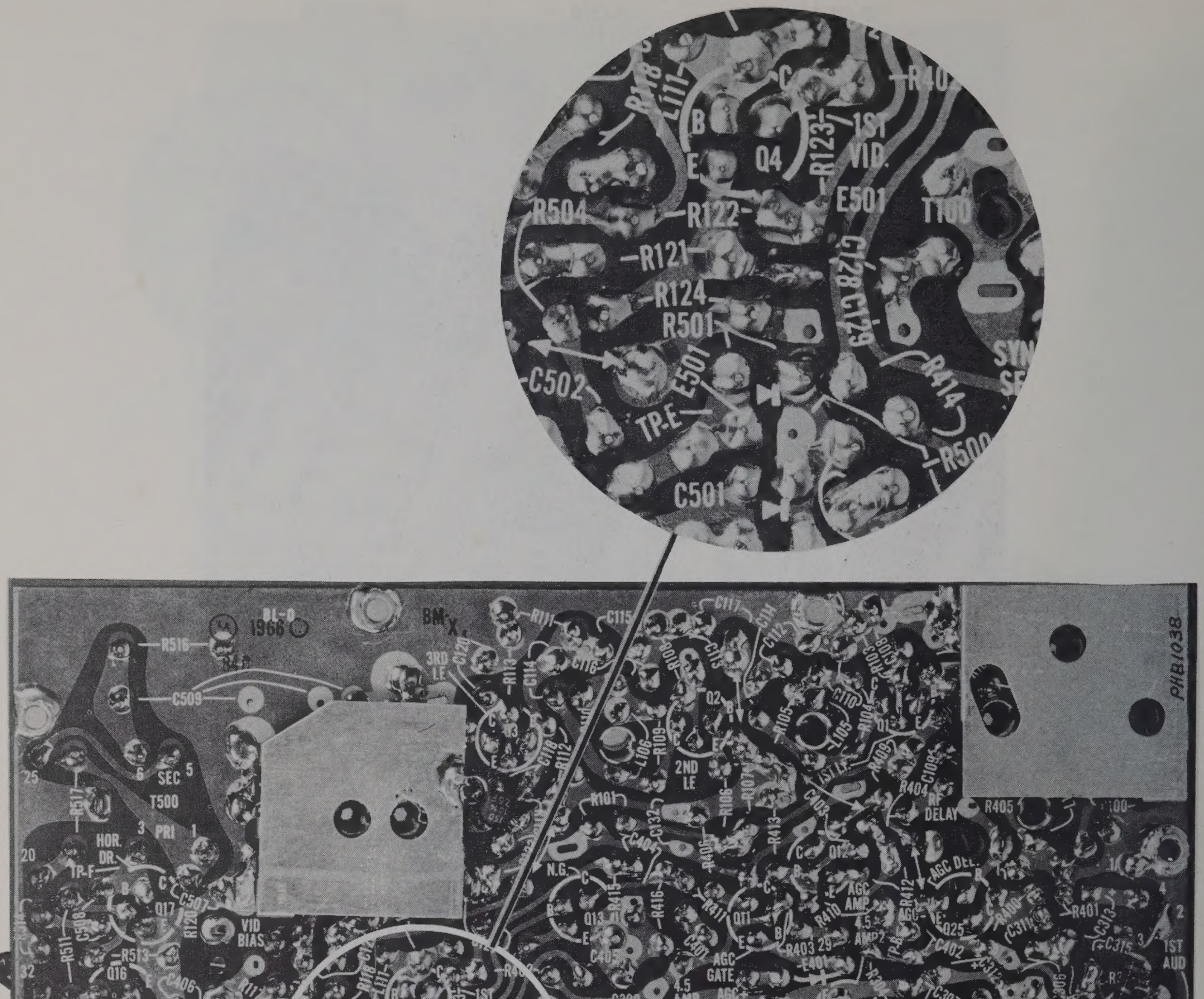
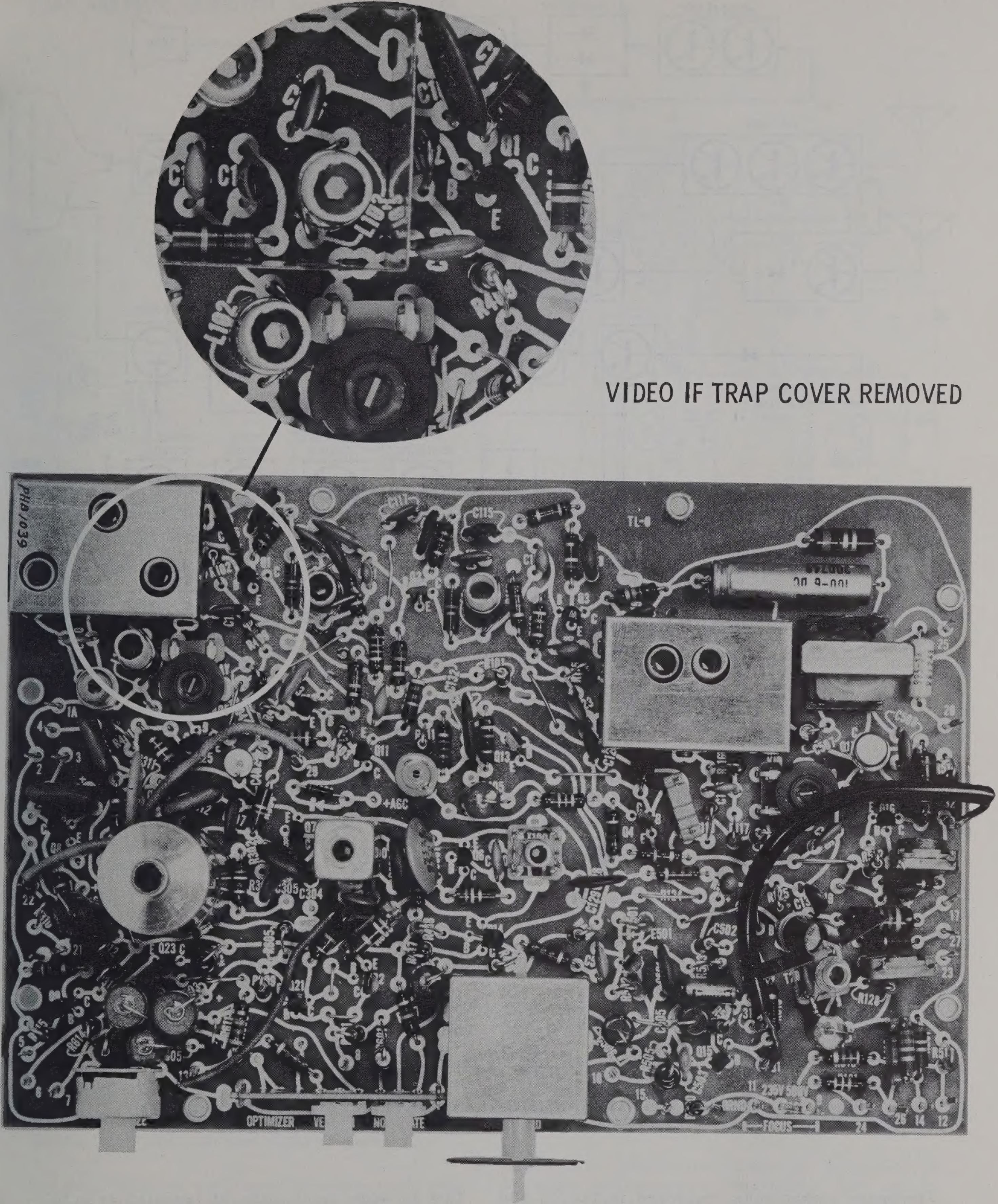

R118
L111
B
E
C
Q4
R123
1ST VID.
E501
T100
R504
R122
R121
R124
R501
C128
C129
C502
TP-E
R414
R500
C501
PHB1038
1966
R516
C509
3RD I.F.
2ND I.F.
1ST I.F.
SEC
T500
PRI
HOR. DR.
TP-F
Q17
C507
VID BIAS
R513
Q16
C406
HOR. SHPR.
L501
R119
R515
R126
L112
T200
R510
R506
HOR. OSC.
500V
235V
R518
R131
C131
R111
C115
Q2
Q1
Q3
L105
L106
R101
C132
C404
N.G.
Q13
Q11
Q12
R416
R411
R410
R403
R412
AGC AMP
AGC GATE
4.5 AMP
AGC DEL.
RF DELAY
R404
R405
Q25
C402
R401
C313
1ST AUD
C300
R300
R301
C302
T300
Q6
Q7
C307
R302
RAT. DET.
Q14
R417
Q22
Q21
TP-G
V. DR.
Q23
V. OSC.
R313
Q9
R315
R616
AUD. DR.
L500
R408
NOISE GATE
R610
V-LIN
OPTIMIZER
V-SIZE

FIGURE 5A - TS-458 CIRCUIT LEGEND - BOTTOM VIEW


VIDEO IF TRAP COVER REMOVED

L101
L102
Q1
B
C
E
R408
PHB/039
TL-6
C115
C117
+AGC
Q11
Q13
C304
C305
Q23
C502
E501
R125
R128
R51
OPTIMIZER
FOCUS
235V 500V

FIGURE 5B - TS-458 CIRCUIT LEGEND - TOP VIEW

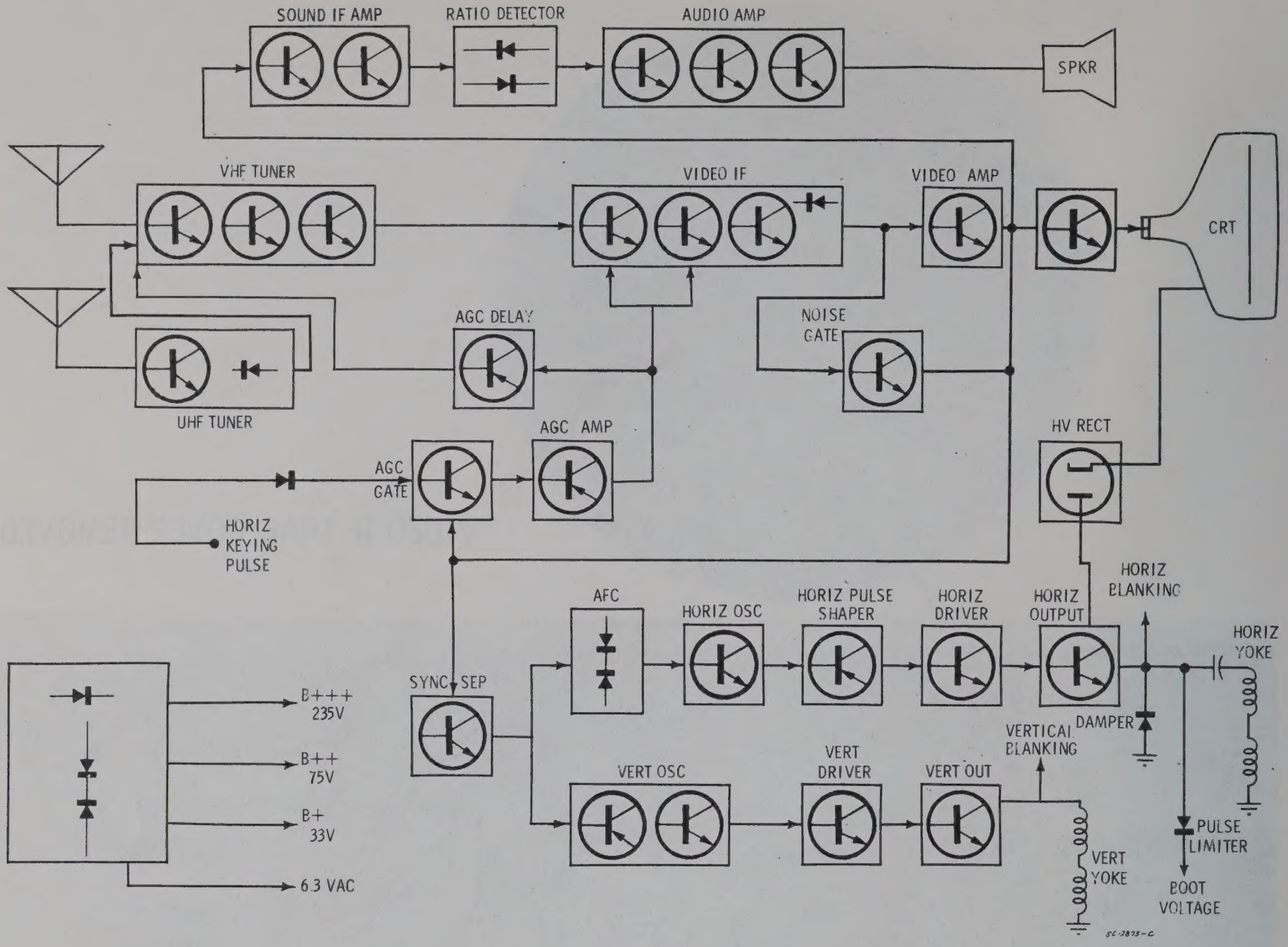

SOUND IF AMP
RATIO DETECTOR
AUDIO AMP
SPKR
VHF TUNER
VIDEO IF
VIDEO AMP
CRT
AGC DELAY
NOISE GATE
UHF TUNER
AGC AMP
HV RECT
AGC GATE
HORIZ KEYING PULSE
HORIZ BLANKING
AFC
HORIZ OSC
HORIZ PULSE SHAPER
HORIZ DRIVER
HORIZ OUTPUT
HORIZ YOKE
SYNC SEP
B+++ 235V
B++ 75V
B+ 33V
6.3 VAC
DAMPER
VERTICAL BLANKING
VERT OSC
VERT DRIVER
VERT OUT
PULSE LIMITER
VERT YOKE
BOOT VOLTAGE
SC-7875-C

FIGURE 6 - TS-458 BLOCK DIAGRAM

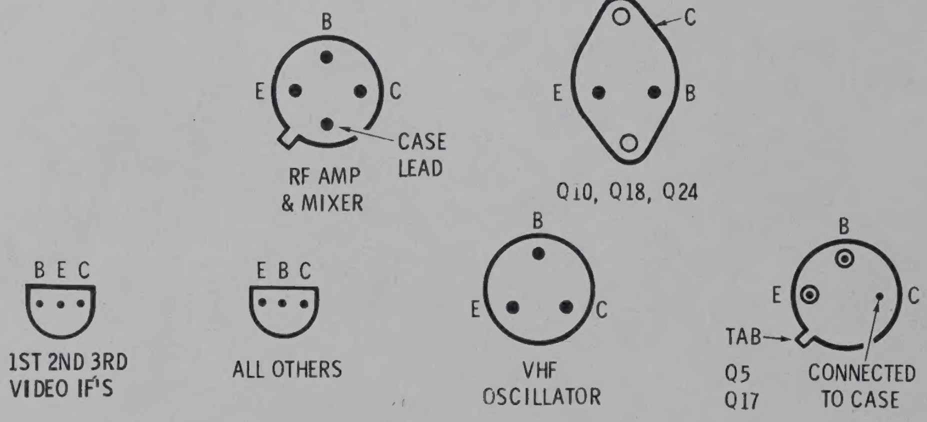

B
E
C
CASE LEAD
RF AMP & MIXER
C
E
B
Q10, Q18, Q24
B E C
1ST 2ND 3RD VIDEO IF'S
E B C
ALL OTHERS
B
E
C
VHF OSCILLATOR
B
E
C
TAB
Q5 Q17
CONNECTED TO CASE

FIGURE 7 - TS-458 TRANSISTOR BASE DIAGRAMS (BOTTOM VIEW)

The main components employed in the TS-458 are 27 transistors, 12 diodes, high voltage rectifier, CRT and a power transformer. It can readily be seen that the stages employed are almost identical to Motorola's tube receivers (see block diagram - Figure #6).

Due to wide application of transistors in television receivers, numerous base configurations must be used. Figure #7 illustrates the various base configurations of all the transistors in the TS-458 receiver.

VHF TUNER CIRCUIT DESCRIPTION

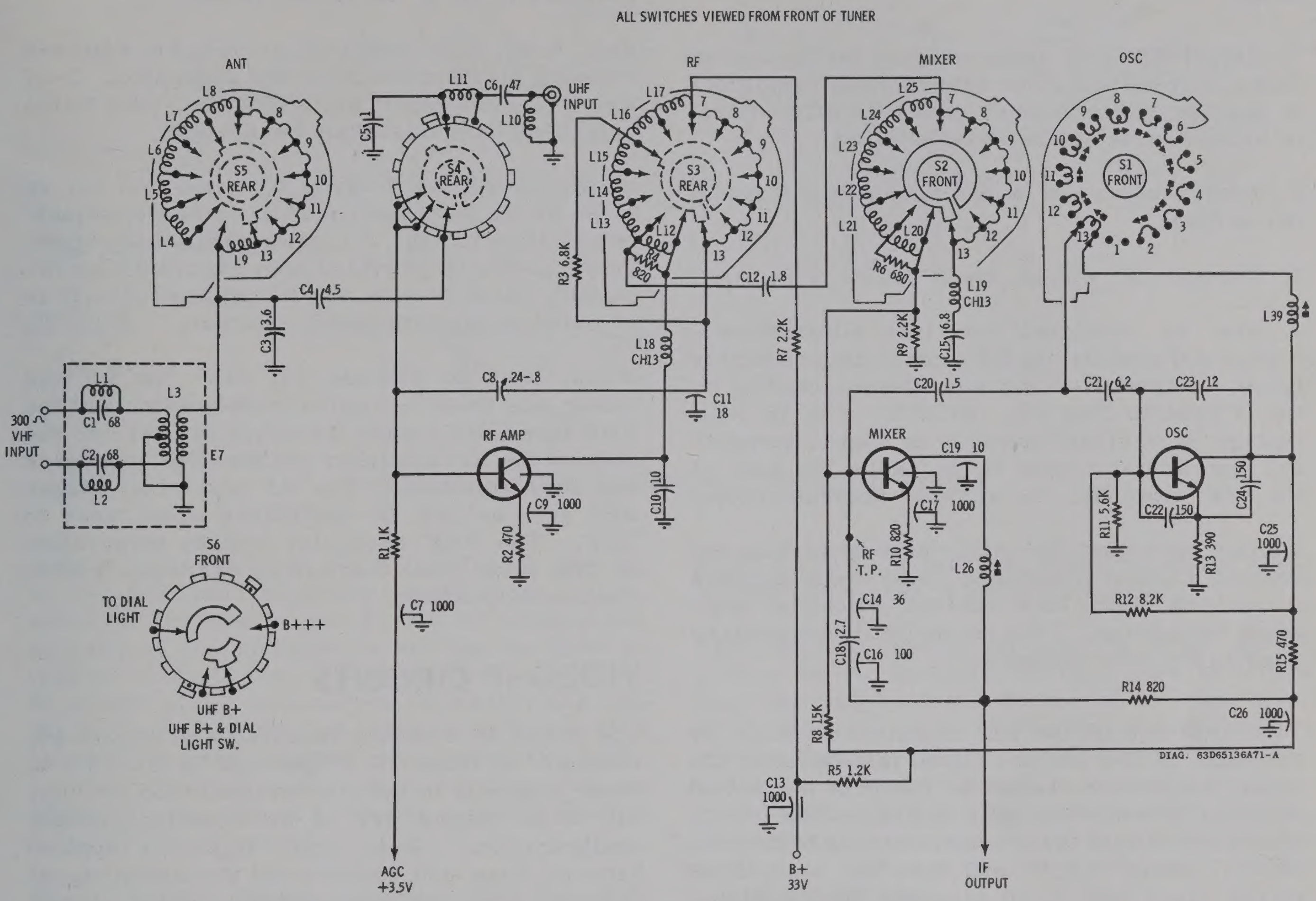

ALL SWITCHES VIEWED FROM FRONT OF TUNER
ANT
RF
MIXER
OSC
S5 REAR
S4 REAR
S3 REAR
S2 FRONT
S1 FRONT
L4
L5
L6
L7
L8
L9
L10
L11
L12
L13
L14
L15
L16
L17
L18 CH13
L19 CH13
L20
L21
L22
L23
L24
L25
L26
L39
C6 47
UHF INPUT
C5 1
C4 4.5
C3 3.6
C8 .24-.8
C11 18
C12 1.8
C10 10
C9 1000
C7 1000
R1 1K
R2 470
R3 6.8K
R4 820
R6 680
R7 2.2K
R9 2.2K
C15 6.8
C20 1.5
C21 6.2
C23 12
300 Ω VHF INPUT
L1
C1 68
C2 68
L2
L3
E7
RF AMP
MIXER
OSC
C19 10
C17 1000
R10 820
RF T.P.
C14 36
C18 2.7
C16 100
R8 15K
R5 1.2K
C13 1000
R11 5.6K
C22 150
R13 390
C24 150
C25 1000
R12 8.2K
R15 470
R14 820
C26 1000
DIAG. 63D65136A71-A
S6 FRONT
TO DIAL LIGHT
B+++
UHF B+
UHF B+ & DIAL LIGHT SW.
AGC +3.5V
B+ 33V
IF OUTPUT
1
2
3
4
5
6
7
8
9
10
11
12
13

FIGURE 8 - TT-394 TUNER

The VHF tuner in the TS-458 is completely transistorized and consists of three stages - RF amplifier, mixer and oscillator (see Figure #8). All three stages are of the common emitter configuration, utilizing NPN transistors. The RF amplifier and mixer have an additional lead connected to their cases for shielding. The oscillator is a conventional three lead transistor. Emitter resistors are inserted in all three stages to provide current stabilization.

Forward AGC is employed as a means of gain control on the RF amplifier. This will be discussed later since the IF also employs forward AGC.

The input signal from the antenna is brought to the base of the RF amplifier through a balun coil (L-3) and a tuned antenna circuit (S5R). The balun coil filters out noise and offers an impedance match from the 300 ohm antenna line to the approximately 200 ohm base impedance of that transistor. Forward bias is established in the RF amplifier by R-1.

Due to the high gain of the RF amplifier, it becomes necessary to neutralize this stage. Capacitor C-8 is adjustable to feed-back the required signal to the base to neutralize this stage.

This neutralizing capacitor (C-8) is adjusted at the factory and does not normally require adjustment, however, in the event adjustment becomes necessary, the following method is proposed.

1. Adjust RF AGC delay control for maximum delay, clockwise. (This allows the RF amplifier to operate with maximum gain.) RF AGC control is located on the main chassis board.

2. Tune receiver to a medium strength signal (snow free).

3. Connect a VTVM on IF AGC T.P. "A".

4. Use an insulated tool (see illustration - Figure #3) to adjust the RF neutralizing capacitor (C-8). Adjust C-8 for a minimum reading on the VTVM in Step #3. (NOTE: The IF AGC voltage is a direct function of signal strength and we actually have to decrease the gain of the RF amplifier to achieve neutralization.)

5. Now re-adjust RF AGC delay by turning the control counter-clockwise until snow appears in picture, then turn control clockwise until snow disappears. This control will be discussed later in the AGC circuits.

The collector of the RF amplifier is tuned by the coils on S3R and the signal is coupled to the mixer tuned base circuit by virtue of the mutual coupling between the coils on S3R and S2F. C-12 offers additional low channel coupling to the base of the mixer. S2F will tune the base of the mixer stage with C-20 injecting the oscillator signal into its base. Forward bias for the mixer is provided by R-5, R-8 and R-9. After the RF and oscillator heterodyne in the mixer base circuit, the IF (44Mc) appears in its collector. L-26 tunes the collector of the mixer series resonant to the IF frequency (44Mc).

R-5, R-15, R-12 and R-11 provide the required forward bias for starting the oscillator. C-21 and C-23 will supply sufficient feed-back to the oscillator base to sustain oscillation.

In the event the desired channels can not be tuned by the individual channel oscillator adjustments (fine tuning), a master oscillator adjustment, L-39, is provided (see Figure #2 for location). Best results will be obtained if L-39 is adjusted on high frequency channels.

When tuned to channel #1, UHF, the RF and mixer are tuned to approximately 44Mc and the UHF tuner will couple its output (44Mc) into the base of the RF amplifier via the UHF input jack and capacitor C-6. The RF and mixer stages will now act as IF amplifiers when tuned to UHF. The VHF oscillator will be inoperative at this time since there is no oscillator coil in channel #1 position.

VIDEO IF CIRCUITS

The video IF system, illustrated in Figure #9, consists of three IF stages and is similar in many respects to the conventional tube system. All three stages are of the common emitter configuration. The input signal is applied between base and emitter and the output signal between collector and emitter, This circuit arrangement makes the base operation compar-

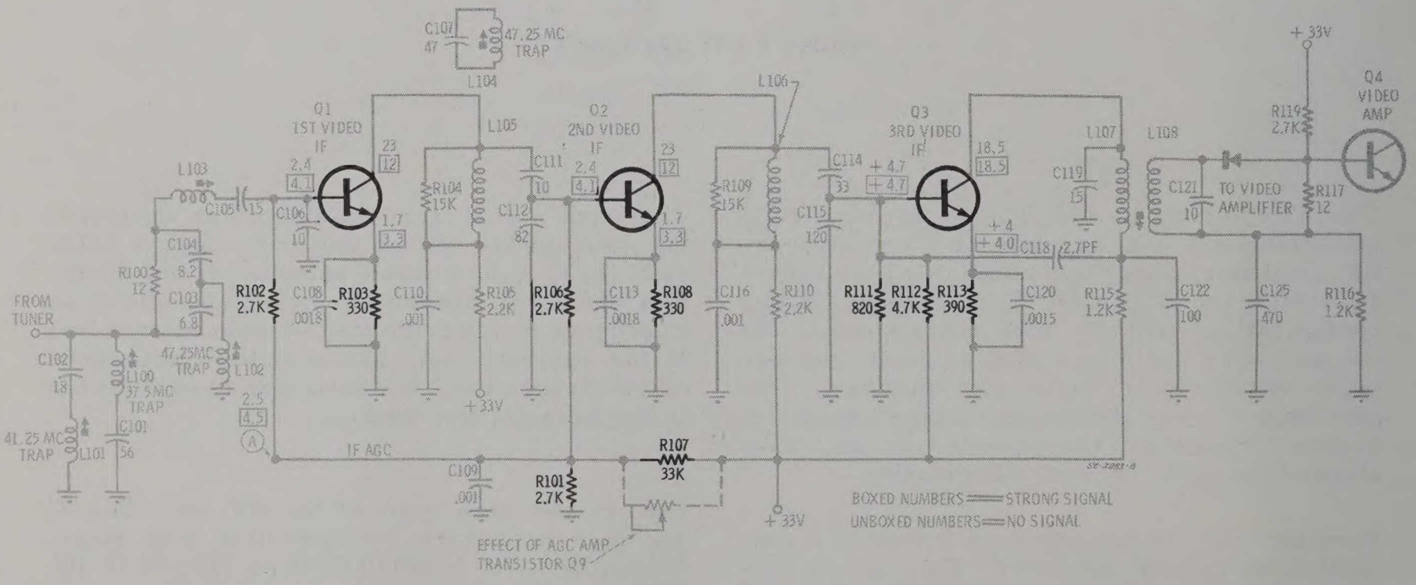

C107
47
47.25 MC TRAP
L104
Q1
1ST VIDEO IF
Q2
2ND VIDEO IF
Q3
3RD VIDEO IF
Q4
VIDEO AMP
L103
C105 15
C106 10
C104 8.2
C103 6.8
R100 12
FROM TUNER
C102 18
L100 37.5MC TRAP
C101 56
41.25 MC TRAP
L101
47.25MC TRAP
L102
R102 2.7K
C108 .0018
R103 330
C110 .001
R104 15K
L105
R105 2.2K
+33V
C111 10
C112 82
R106 2.7K
C113 .0018
R108 330
2.4
[4.1]
23
[12]
1.7
[3.3]
2.5
[4.5]
A
IF AGC
C109 .001
R101 2.7K
R107 33K
EFFECT OF AGC AMP TRANSISTOR Q9
L106
R109 15K
C116 .001
R110 2.2K
C114 33
C115 120
+4.7
[+4.7]
18.5
[18.5]
+4
[+4.0]
C118 2.7PF
R111 820
R112 4.7K
R113 390
C120 .0015
L107
C119 15
R115 1.2K
C122 100
L108
C121 10
TO VIDEO AMPLIFIER
C125 470
R119 2.7K
R117 12
R116 1.2K
+33V
SK-2283-B
BOXED NUMBERS = STRONG SIGNAL
UNBOXED NUMBERS = NO SIGNAL

FIGURE 9 - BIAS PATHS - THREE STAGE IF SYSTEM

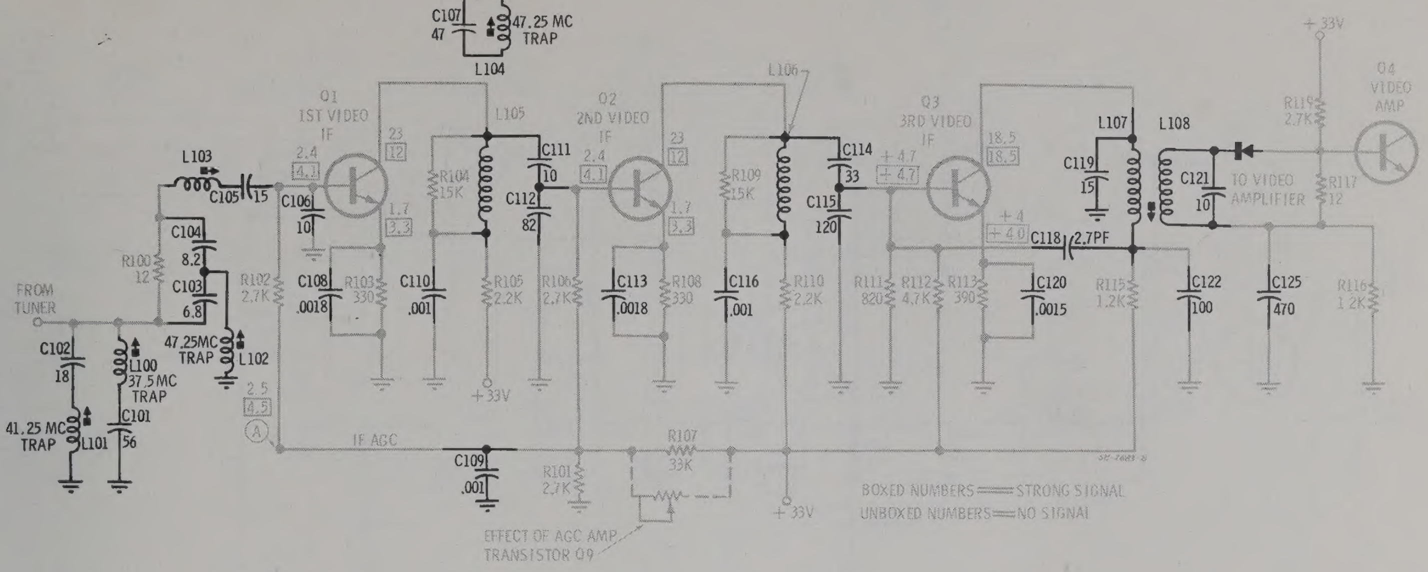

C107
47
47.25 MC
TRAP
L104
Q1
1ST VIDEO
IF
L105
Q2
2ND VIDEO
IF
L106
Q3
3RD VIDEO
IF
L107
L108
+33V
Q4
VIDEO
AMP
R119
2.7K
L103
C105
15
C106
10
2.4
4.1
23
12
1.7
3.3
R104
15K
C111
10
C112
82
2.4
4.1
23
12
1.7
3.3
R109
15K
C114
33
+4.7
+4.7
C115
120
18.5
18.5
+4
+4.0
C118
2.7PF
C119
15
C121
10
TO VIDEO
AMPLIFIER
R117
12
C104
8.2
R100
12
C103
6.8
FROM
TUNER
R102
2.7K
C108
.0018
R103
330
C110
.001
R105
2.2K
R106
2.7K
C113
.0018
R108
330
C116
.001
R110
2.2K
R111
820
R112
4.7K
R113
390
C120
.0015
R115
1.2K
C122
100
C125
470
R116
1.2K
C102
18
L100
37.5MC
TRAP
47.25MC
TRAP
L102
C101
56
41.25 MC
TRAP
L101
2.5
4.5
A
IF AGC
+33V
C109
.001
R101
2.7K
R107
33K
+33V
EFFECT OF AGC AMP.
TRANSISTOR Q9
BOXED NUMBERS ═══ STRONG SIGNAL
UNBOXED NUMBERS ═══ NO SIGNAL

FIGURE 10 - SIGNAL PATHS - THREE STAGE IF SYSTEM

able to the grid in a tube, the collector similar to the plate, and the emitter like a cathode. Also, since the transistors are silicon NPN types, the polarity of the voltages is similar to tubes in that the collector has a positive voltage (similar to a tube plate), and current increases through the transistor as the base is made more positive (similar to less negative on a tube grid). The emitter resistor develops a positive voltage which is a function of collector current (similar to a cathode resistor).

The forward bias networks for the AGC controlled stages (1st and 2nd IF) connect to the junction of R-101 and R-107 which forms a voltage divider from +33 volts. A voltage in the order of 2.5 volts is developed at the IF AGC under no signal conditions. This 2.5 volt bias source produces approximately .7 volts forward bias between base and emitter of the first two IF stages which provides maximum gain. When a signal is received, the AGC system acts as a variable resistor in parallel with R-107. The effect is a reduction in value of R-107 so more voltage will be developed at T.P. "A". The voltage developed at T.P. "A" will be directly proportional to the strength of the signal received. A strong signal will produce more voltage than a weak one. A nominal value for a moderately strong signal (snow free) is 4.5 volts. Note that the forward bias source voltage has increased from 2.5 volts with no signal to 4.5 volts with signal. This results in a forward bias potential (or forward AGC) of .8 volts to be developed between base and emitter which increases collector current and reduces stage gain. This will be discussed later.

The 3rd video IF is forward biased from a fixed voltage divider network R-111 and R-112.

Figure #10 is a diagram of the complete video IF with the signal paths in dark print.

The coupling circuit between the tuner and IF system is very similar to that used in a tube receiver and contains the usual 41.25Mc trap. In addition, a 37.5Mc trap is incorporated to achieve upper adjacent channel video rejection. Optimum adjacent channel rejection is realized when this trap is tuned to approximately 37.5Mc. Its physical location is easily accessible for any additional touch-up in the field under actual signal conditions.

There are two 47.25Mc traps to insure lower adjacent channel sound rejection. The first is a bridge "T" trap arrangement in the base circuit of the 1st video IF. The second is in the form of an absorption trap in the collector circuit of the first IF. Both of these traps are adjusted for maximum attenuation at 47.25Mc.

L-103, C-105 and C-106 form a series resonant circuit which tunes the base or input circuit of the 1st IF stage. C-105 blocks DC from the tuner to the base and, in conjunction with C-106, effects a match to the base. All three IF transistors are NPN with a positive voltage applied to their collectors. An emitter resistor is used in each stage for stabilization and is by-passed with a capacitor. Collector voltage is supplied from a +33 volt line.

The third IF stage is neutralized by C-118 which couples a small portion of the output back to the base to off-set or neutralize the feed-back from collector to base.

Note that if C-122 offered complete by-passing, C-118 could not couple any signal back to the input.

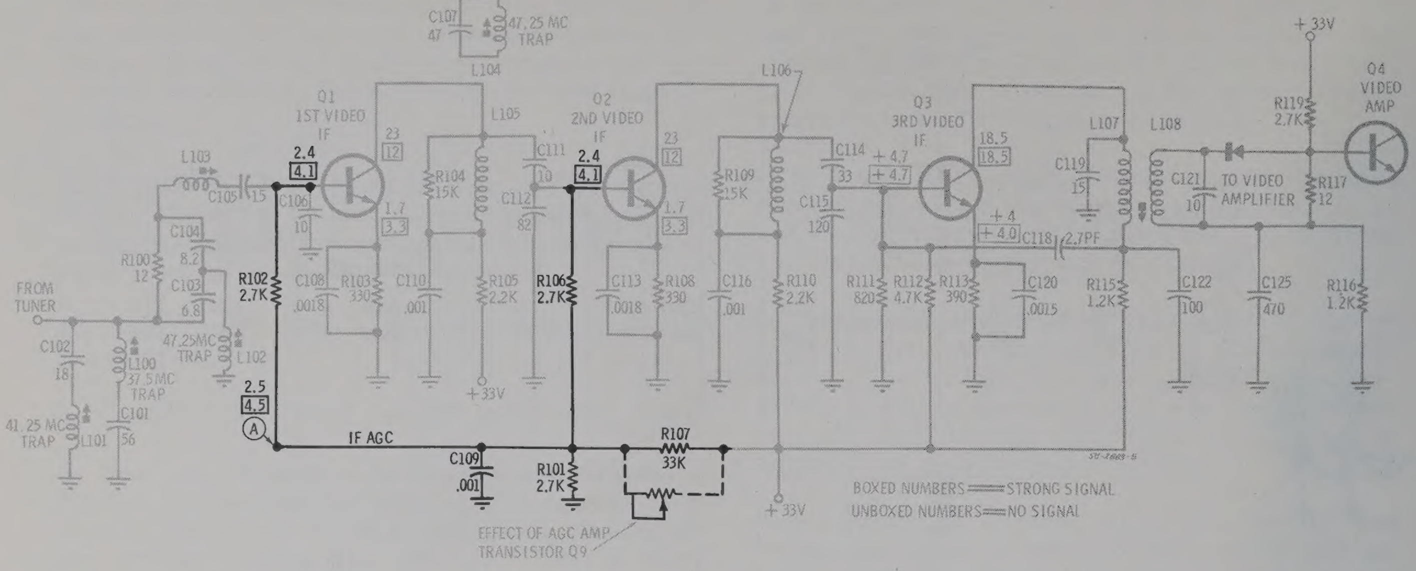

C107
47
47.25 MC TRAP
L104
Q1
1ST VIDEO IF
Q2
2ND VIDEO IF
Q3
3RD VIDEO IF
Q4
VIDEO AMP
+33V
L106
L105
L103
L107
L108
R119
2.7K
2.4
4.1
23
12
1.7
3.3
18.5
18.5
+4.7
+4.7
+4
+4.0
C105
15
C106
10
C104
8.2
C103
6.8
R100
12
R104
15K
C111
10
C112
82
R109
15K
C114
33
C115
120
C119
15
C121
10
TO VIDEO AMPLIFIER
R117
12
C118
2.7PF
FROM TUNER
R102
2.7K
C108
.0018
R103
330
C110
.001
R105
2.2K
R106
2.7K
C113
.0018
R108
330
C116
.001
R110
2.2K
R111
820
R112
4.7K
R113
390
C120
.0015
R115
1.2K
C122
100
C125
470
R116
1.2K
C102
18
L100
37.5MC TRAP
47.25MC TRAP
L102
C101
56
41.25 MC TRAP
L101
2.5
4.5
A
IF AGC
C109
.001
R101
2.7K
R107
33K
+33V
EFFECT OF AGC AMP TRANSISTOR Q9
BOXED NUMBERS = STRONG SIGNAL
UNBOXED NUMBERS = NO SIGNAL

FIGURE 11 - AGC PATH - THREE STAGE IF SYSTEM

The output (or collector) circuitry for the first two stages is tuned to the center of the overall video IF response (approximately 44Mc). These coils, L-105 and L-106, are very broad and contribute little to the overall selectivity of the system. Along with other circuit capacity, two capacitors, in series, are used to resonate L-105 and L-106 and offer a convenient method of capacity coupling from one stage to the other. Their ratio of one to the other can be selected to attain the desired signal transfer and matching to the next stage.

Selectivity in the overall system is accomplished by the traps in the input circuitry and the band width by the over-coupled 3rd IF or second detector transformer. For this reason, L-105 and L-106 are not tunable.

The video detector output is DC coupled to the base of the video amplifier (Figure #11). Note that while the detector is connected to ground for IF (C-125), it is off ground for DC to establish forward bias for the first video amplifier.

Optimum gain in a transistor IF amplifier occurs when the transistor is biased approximately half way between cutoff and saturation. Biasing the IF transistor above or below this optimum point lowers the amplifier's gain.

If a gain reduction is achieved by lowering the transistor's emitter-to-base forward bias, reverse AGC is employed. If gain reduction is achieved by raising the transistor's emitter-to-base forward bias, forward AGC is employed. In the TS-458 forward AGC is chosen to affect a gain reduction in the first and second video IF transistors.

Similar to tube receivers, the TS-458 operates

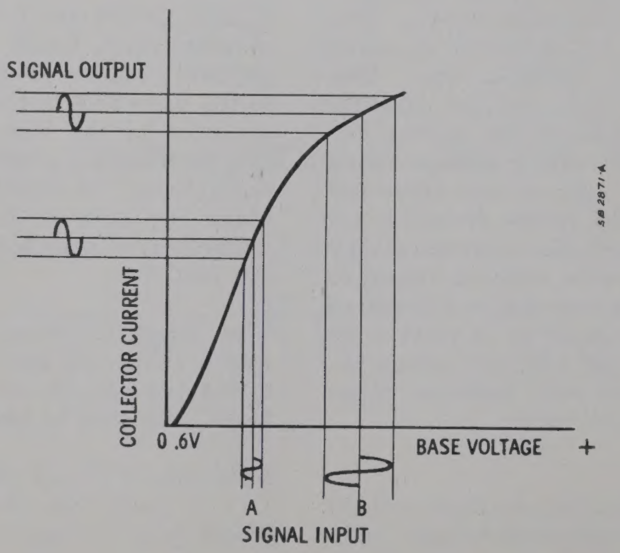


FIGURE 12 - TRANSFER CURVE INDICATING GAIN REDUCTION BY FORWARD AGC

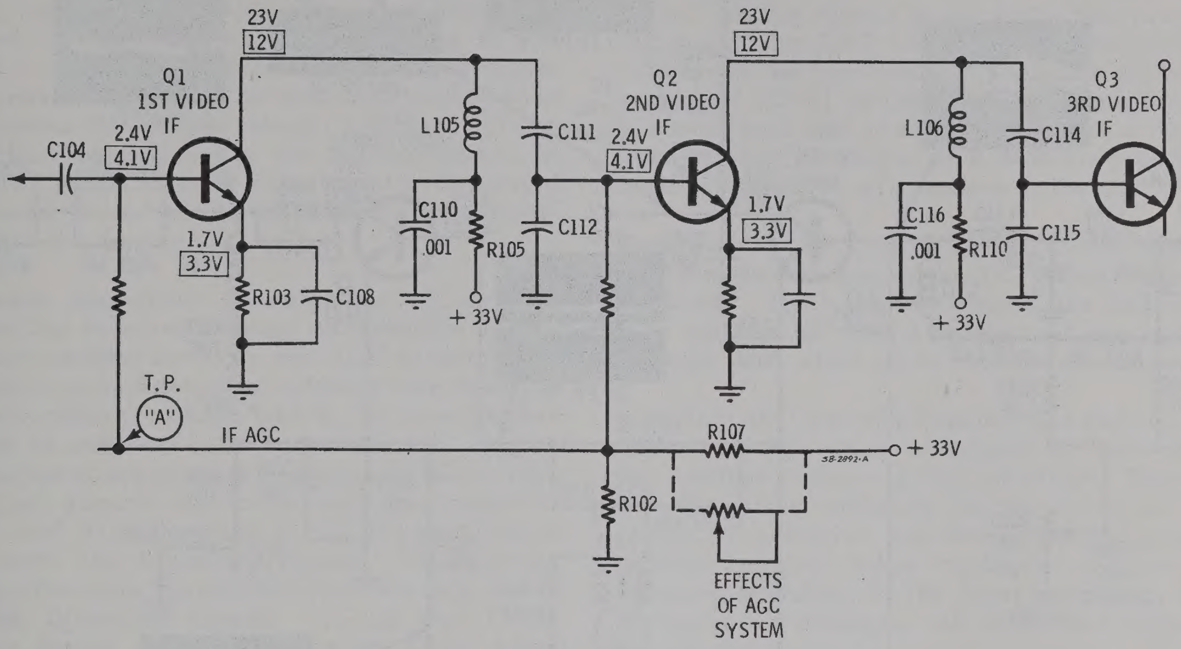


FIGURE 13 - SIMPLIFIED IF CIRCUIT SHOWING IF VOLTAGES WITH AND WITHOUT SIGNAL

with maximum gain when no signal is received. When a signal is received, a gain reduction in the first two video IF transistors is accomplished by applying a positive voltage (note this is forward bias) to their bases (see Figure #11). This is illustrated by the transfer curve of Figure #12. Signal "A" represents a weak signal at which time no AGC is developed, and the IF gain is maximum. Signal "B" represents a large signal received; however, the output is the same in both cases due to a reduction in gain by forward biasing the IF.

Figure #13 is a simplified diagram of the TS-458 IF with forward AGC applied, The voltages in the boxes indicate normal signal conditions, and the voltages outside indicate no signal conditions.

Under "no signal" conditions, the IF gain is maximum because no forward AGC is developed by the AGC system. The absence of forward AGC between each IF transistor's emitter and base is evident by the rise in collector voltage (Q-1 and Q-2 - Figure #13).

When a medium strength signal is received, a positive voltage is developed by the AGC system, and applied to each (NPN) IF transistor base (Q-1 and Q-2). With a rise in emitter-to-base forward bias (AGC), the collector current increases. Since the collector power is the product of collector voltage times collector current, this power could exceed the transistor's maximum rating (due to increased forward bias) if collector voltage is not lowered as collector current rises. Two dropping resistors, R-105 and R-110, inserted in series with the collectors of each IF transistor, Q-1 and Q-2 - Figure #13, serve to lower the collector voltage when the collector current is high. As a result, transistor power (voltage times current) is maintained at a safe value when forward AGC is applied.

Even with no AGC applied, R-105 and R-110, in series with the IF coils, L-105 and L-106, have a tendency to lower the circuit "Q" and will decrease the gain in the IF system. To allow these resistors to limit transistor collector power, without lowering the circuit "Q", we employ C-110 and C-116 as by-passes.

VIDEO AMPLIFIER AND OUTPUT CIRCUITS

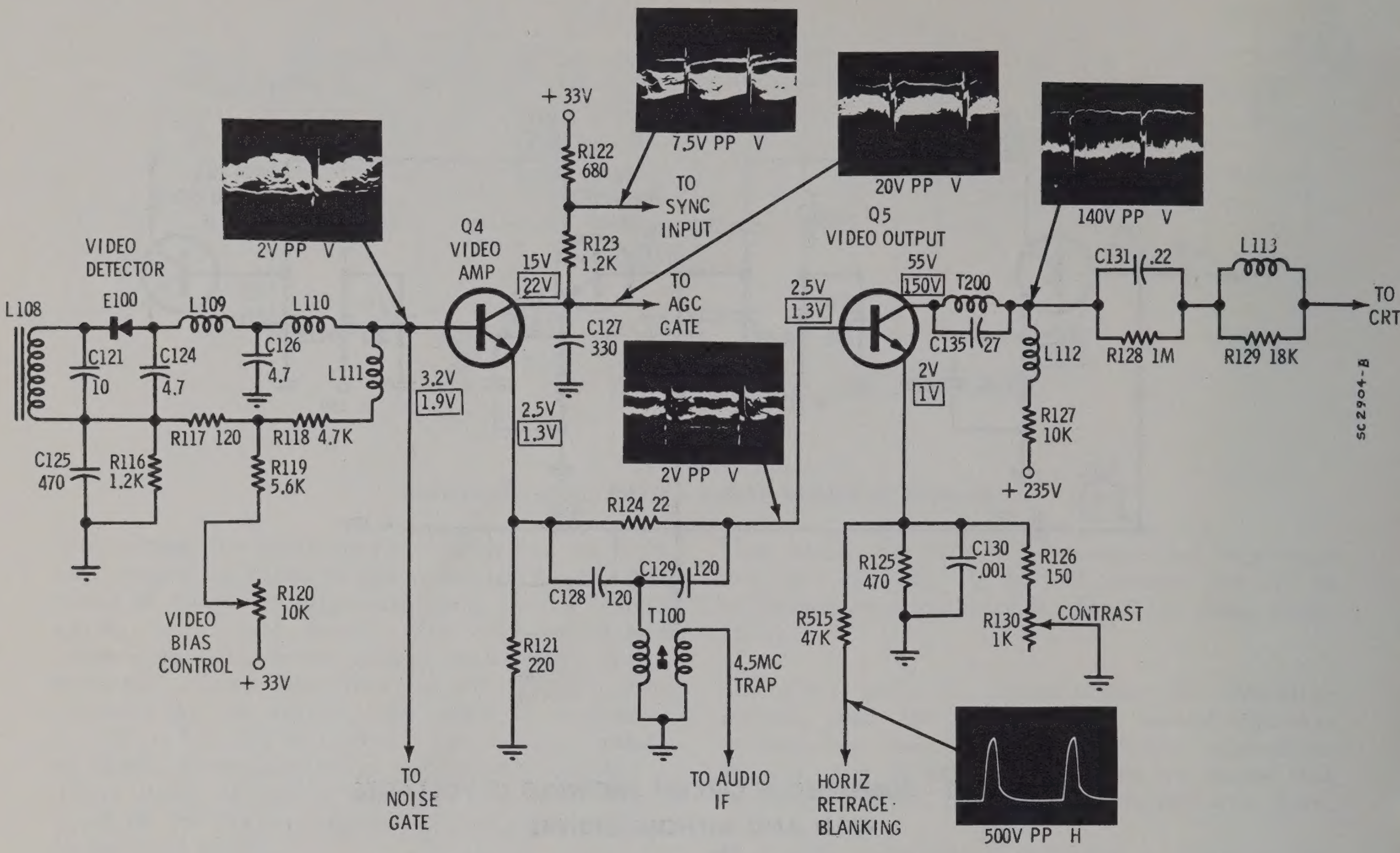

+ 33V
R122 680
7.5V PP V
TO SYNC INPUT
TO AGC GATE
20V PP V
140V PP V
2V PP V
VIDEO DETECTOR
L108
E100
C121 10
C124 4.7
L109
L110
C126 4.7
L111
C125 470
R116 1.2K
R117 120
R118 4.7K
R119 5.6K
R120 10K
VIDEO BIAS CONTROL
+ 33V
Q4 VIDEO AMP
15V
22V
R123 1.2K
C127 330
3.2V
1.9V
2.5V
1.3V
2V PP V
R124 22
C128 120
C129 120
T100
4.5MC TRAP
R121 220
TO NOISE GATE
TO AUDIO IF
Q5 VIDEO OUTPUT
55V
150V
2.5V
1.3V
T200
C135 27
2V
1V
L112
R127 10K
+ 235V
C131 .22
R128 1M
L113
R129 18K
TO CRT
R125 470
C130 .001
R126 150
R130 1K
CONTRAST
R515 47K
HORIZ RETRACE BLANKING
500V PP H
SC2904-B

FIGURE 14 - VIDEO AMPLIFIER AND OUTPUT CIRCUIT

A two stage video amplifier is used in the TS-458. The first stage is used to provide a relatively high impedance load to the second detector and a low impedance source for the video output. Since audio, sync and AGC information are taken from the output of the video amplifier, the video output can be designed to take advantage of this to affect a 25% increase in video output over what could be obtained if sync, sound and AGC information had to be retained. As a result, a 150V PP video output signal, with clipped sync, is equivalent to a 200V PP video signal without clipped sync pulses.

Forward bias for the video amplifier (Q-4 - Figure #14) is provided by R-118, R-117, R-116, R-119 and R-120. The video bias control, R-120, is adjustable and is used to vary the bias of the video amplifier (Q-4). Since the video output (Q-5) base circuit is connected back to the emitter of the video amplifier, any change in bias setting of R-120 will also change the conduction of Q-5, video output. Bias for Q-5 is derived by the current flowing through the emitter resistor (R-121) of the video amplifier (Q-4).

With forward bias applied at Q-4, video amplifier, a portion of the electron flow is through its emitter resistance, R-121, the emitter base junction, L-111 and R-118 (detector load resistor) R-119 and R-120.

When the IF is amplifying, noise or signal is applied to the second detector diode. The diode conducts on the negative portions of the signal and electrons flow through L-109, L-110, L-111, R-118, R-117 and L-108. The electron flow in R-118 causes a voltage drop due to signal or noise which is in opposition to the bias voltage, thus reducing the forward bias on this stage.

Since the 2nd detector output is quite variable with signal strength, noise, etc., it is necessary to eliminate its effect when adjusting the video amplifier bias. This can be done by simply disabling the video IF.

1. Cut off video IF by shorting emitter to base of 3rd IF and setting the channel selector between channels.

2. Turn contrast control fully clockwise (maximum contrast).

3. Adjust video bias control, R-120, for a 25

volt reading on a VTVM at the collector of the video output, Q-5.

While the +25 volts on the collector of Q-5 is not exceptionally critical, a lower voltage may tend to cause white limiting and higher positive voltage will reduce the overall system gain. If it becomes necessary to adjust the video bias control while viewing the picture, it should be adjusted clockwise until white limiting is observed on either a local channel or in the noise on an unused channel. The control is then backed off counter-clockwise about 1/4 turn (90°). While this procedure is not recommended, it will offer some form of adjustment in the event it becomes necessary to adjust the video amplifier without a meter.

The video amplifier operates as an emitter follower for video and sound information and as a common emitter for sync and AGC information. Changes in second detector output cause changes in base/emitter voltage which, in turn, causes changes in emitter/collector current. Changes in collector current causes changes in the voltage developed across the collector load resistor (R-123 and R-122) which is 180 degrees out of phase with the incoming signal. The voltage developed across the emitter resistor is in phase with the incoming signal. C-128 and T-100 primary forms a series resonant 4.5Mc trap. Since this trap offers minimum impedance at resonance, little sound IF information will be developed across the emitter resistor (R-121). The 4.5Mc sound information will be developed across the secondary of T-100 because of high current in the primary at the resonant frequency. Also, a composite video signal will be developed across the collector load resistors and coupled directly to the base of the AGC gate transistor. Sync pulse information is also taken from the collector circuit using a voltage divider (R-123 and R-122) to reduce its level to the desired amount.

The emitter resistance of Q-5 is in the order of 250 ohms. The contrast control, R-130, introduces degeneration in the emitter circuit when set toward minimum contrast (maximum resistance). C-130 provides some by-passing of the higher frequencies to provide better high frequency response.

The collector load consists of L-112 and R-127. L-112 and L-113 improve high frequency response. R-128 allows only a small amount of DC coupling to the CRT. The video information is AC coupled by way of capacitor C-131.

Horizontal retrace blanking is provided by introducing a positive horizontal pulse from the collector circuit of horizontal output, Q-18, through R-515 to the emitter of the video output. This positive pulse turns off the video output (Q-5). The collector voltage of the video output will then rise biasing off the CRT during the horizontal retrace interval.

SERVICING THE VIDEO AMPLIFIER AND OUTPUT

Since the video circuitry is basically a low frequency amplifier from detected video signals up to 4.5Mc, it is usually a simple matter to determine if the two stages are functioning. Signal tracing with a scope is the best procedure althrough the CRT can be used as an indicator. Noise can be injected into the base of the video amplifier (Q-4) by touching with your finger or a metal tool and noting the effect on the CRT screen. If both stages and CRT are functioning, noise or flashing will be seen on the CRT screen.

Should this check or a scope check indicate a non-functioning stage, the DC voltages should be checked. Since the two stages are DC coupled, it is quite likely that a defect that would disable a stage will show up in voltage measurements.

Note that the forward bias for the 2nd stage (and hence, its operating voltages) is derived from the emitter voltage of the 1st stage. Therefore, the operating voltages of the video amplifier should be observed and determined to be proper before the 2nd stage voltages are evaluated because a defect in the first stage that affects its operating voltages will affect the voltages on the second stage.

If the current through the 1st stage is incorrect (as indicated by incorrect voltages), the video bias adjustment should be checked. Remove the effect of the video detector output as previously discussed and adjust the bias control for 25 volts on the collector of the second stage.

If the video output collector voltage can be correctly adjusted for 25 volts, restore the video detector to normal operation and proceed with scope or voltage checks on the stages. However, if the collector voltage on the 2nd stage cannot be adjusted to 25 volts, the base voltage on the video amplifier should be checked (effect of video detector output still removed) to assure that the video bias control can be adjusted to provide +3.4 volts on the video amplifier base. Failure to obtain +3.4 volts or just obtaining +3.4 volts at either end of the control is indicative of a defect in the noise gate circuitry, 3rd video IF stage, video amplifier bias circuit or base/emitter junction of the video amplifier transistor. These circuits should be analyzed with the objective of obtaining +3.4 volts on the base of the video amplifier.

After +3.4 volts is obtained with the video bias control on the base of the video amplifier voltage checks in the stages will generally disclose the problem since this is very close to the correct bias voltage for the input stage to provide 25 volts on the collector of the output stage.

Once the voltages on the first stage are established to be correct, the second stage voltages

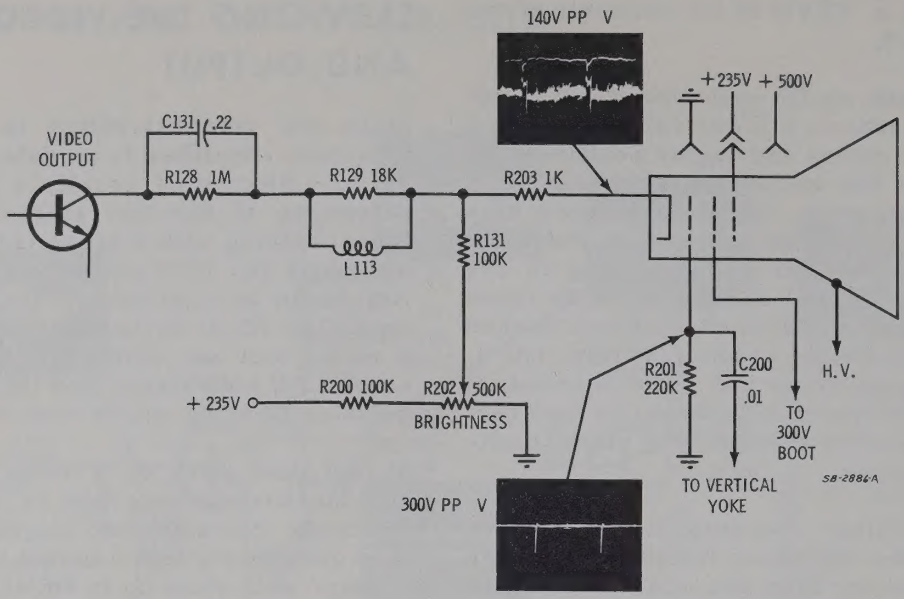


FIGURE 15 - CRT CIRCUIT

are evaluated. Average voltages, with and without signal, are shown on the schematic.

These checks should disclose the majority of defects since the stages are direct coupled and there are only a few components in the signal path that could disable the stage without also affecting the DC voltages.

For any further check, an oscilloscope should be used. Tune the receiver to a blank channel or a very weak one so that there is no possibility of AGC overload that might be caused by a defect in the video amplifier stage. Starting at the base of the video amplifier, check toward the CRT looking for a loss of noise or picture information.

Care should be used particularly in the second stage to avoid shorting the collector to either of the other elements. The relatively high collector potential could destroy the transistor if it is accidently shorted to the other elements.

PICTURE TUBE CIRCUITRY

Since basically the same CRT is used in both tube and transistorized receivers, it follows that the CRT circuitry will be the same for either type receiver.

The TS-458 CRT circuitry is shown in Figure #15. The brightness control allows an adjustable amount of positive voltage (approximately +30 volts at maximum brightness and +150 volts at minimum brightness) to the CRT cathode. This sets the bias or brightness on the CRT.

Automatic vertical retrace blanking is accomplished in the CRT G-1 circuit. A pulse from the vertical yoke is coupled to this grid by capacitor C-200. During vertical retrace, a high amplitude negative pulse is present turning the CRT off. The R-C time constant of C-200 and R-201 is chosen (short R-C time) so that the positive going long duration voltage, present during vertical trace, will not appear on the grid and cause a shading effect on the screen. Only the short duration negative pulse that occurs during retrace will appear at this point.

Focus voltage is supplied in the usual manner. Three focus potentials are available; filtered boot, B+ 235V and ground. The plug is simply connected to the potential that provides the overall focus.

AGC SYSTEM

The RF and IF gain in a television receiver must be varied in accordance with the strength of the received signal. A strong signal requires a gain reduction of both RF and IF amplifiers in order to prevent overloading in the system. When a medium strength (snow free) signal is received, only a reduction in IF gain is necessary, thus, allowing the RF amplifier to operate with maximum gain. When a weak signal (snowy picture) is received, no AGC is applied to the RF and a small amount to the IF. In short, the output of the system must be kept constant regardless of the strength of the received signal.

By not applying any AGC to the RF amplifier during the reception of weak and medium strength signals, excellent signal to noise characteristics can be achieved in the tuner by virtue of the high "RF/mixer noise" ratio. In essence, when a large RF signal is applied to the mixer, it overrides the noise generated within the mixer. The IF output signal from the mixer is now relatively noise free, which ultimately would produce a

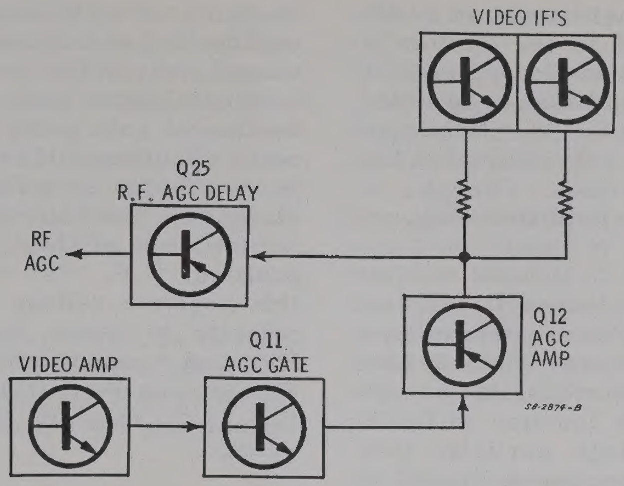

VIDEO IF'S
Q25
R.F. AGC DELAY
RF
AGC
Q12
AGC
AMP
VIDEO AMP
Q11
AGC GATE
SB-2874-B

FIGURE 16 - BLOCK DIAGRAM OF AGC SYSTEM

noise free picture on the television screen. The AGC applied to the tuner is therefore delayed until the received signal is of such magnitude that any further increase in signal would cause the tuner to overload. The delayed RF AGC stage will then turn on and allow a reduction in RF amplifier gain for any further increase in the received signal.

The AGC system in the TS-458 is keyed (gated) and consists of three stages: AGC gate (Q-11), AGC amplifier (Q-12) and RF AGC delay (Q-25 - see Figure #16).

When tuned between channels, Q-11 is reverse biased by the low collector voltage of the video amplifier (Q-4). Q-4 produces a large voltage drop across R-403 (see simplified diagram - Figure #17). This voltage causes the base of Q-11 to be negative with respect to its emitter, thereby reverse biasing its emitter/base junction which prevents it from conducting. When tuned to a channel, the video amplifier, Q-4, will be driven toward cut-off by the negative sync pulses and DC voltage introduced to its base from the second detector, E-100. As a result, the collector current of Q-4 decreases, the voltage drop across R-403 will then reduce. This, in turn, will elevate the base of Q-11 to a higher positive voltage with respect to its emitter which will forward bias it and would allow collector current to flow, providing we apply a positive voltage to its collector that is higher than the emitter voltage. (This voltage must be in excess of +33 volts in order to exceed the emitter voltage and cause conduction.)

A pulse coil wound on the flyback transformer will introduce a +40 volts PP positive pulse to the anode of E-401. This pulse will forward bias E-401 turning it on. The pulse will then appear on the collector of Q-11. Q-11 will now conduct charging C-402 in the following manner.

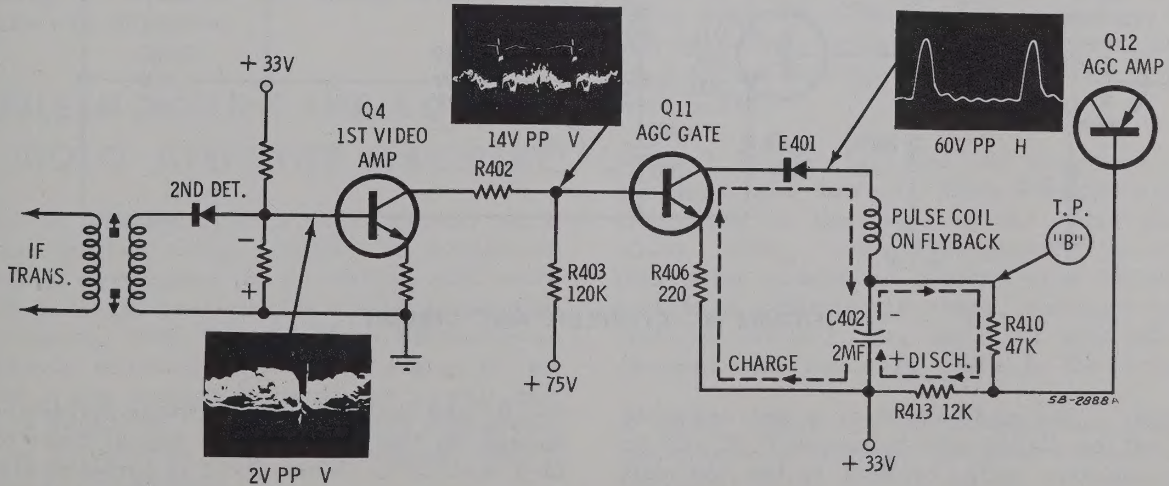

+ 33V
Q4
1ST VIDEO
AMP
14V PP V
R402
Q11
AGC GATE
E401
60V PP H
Q12
AGC AMP
2ND DET.
IF
TRANS.
PULSE COIL
ON FLYBACK
T.P.
"B"
R403
120K
R406
220
C402
2MF
R410
47K
CHARGE
+ DISCH.
+ 75V
R413 12K
+ 33V
2V PP V
SB-2888

FIGURE 17 - SIMPLIFIED AGC GATE CIRCUIT SHOWING CHARGE & DISCHARGE PATH OF C402

Electrons will flow off the positive side of C-402 thru limiting resistor R-406 to the emitter of Q-11. These electrons will then flow thru E-401 and the horizontal pulse coil ultimately accumulating on the negative side of C-402. It charges to a negative value directly proportional to the amplitude of the received signal. Charging of C-402 is indicated in the simplified diagram (see Figure #17).

After the horizontal pulse leaves C-402 now wants to discharge, however, the negative voltage on C-402 will turn off (reverse bias) E-401. This prevents C-402 from discharging through the collector to base diode junction of Q-11. Instead, C-402 will discharge partially thru R-410 and R-413 in the direction indicated in Figure #17.

It should be noted that C-402 charged up rapidly through a relatively small resistance but discharged only partially through a relatively large resistance. The end result is a net negative charge left on C-402 which causes T.P. "B" to become negative with respect to the +33 volt supply.

The magnitude of the negative voltage developed at T.P. "B" with respect to the +33 volt supply is directly proportional to the amplitude of horizontal sync pulse on the base of Q-11. (The horizontal sync pulse on the base of Q-11 and horizontal gate pulse on the collector of Q-11 occur simultaneously with the sync pulse varying in amplitude as a function of received signal strength.) The higher the horizontal sync pulse on the base of Q-11, the more negative (less positive) T.P. "B" becomes. Unfortunately, this negative voltage does not have the proper polarity to cause forward AGC action on the IF's and tuner to affect a gain reduction. For this reason, we must incorporate another amplifier, Q-12, to invert the polarity of this negative voltage.

Q-12 is a common emitter (PNP) AGC amplifier (see Figure #18). The voltage developed at T.P. "B" is negative going (less positive) and will forward bias Q-12 causing it to turn on. Effectively, Q-12 is in parallel with R-107.

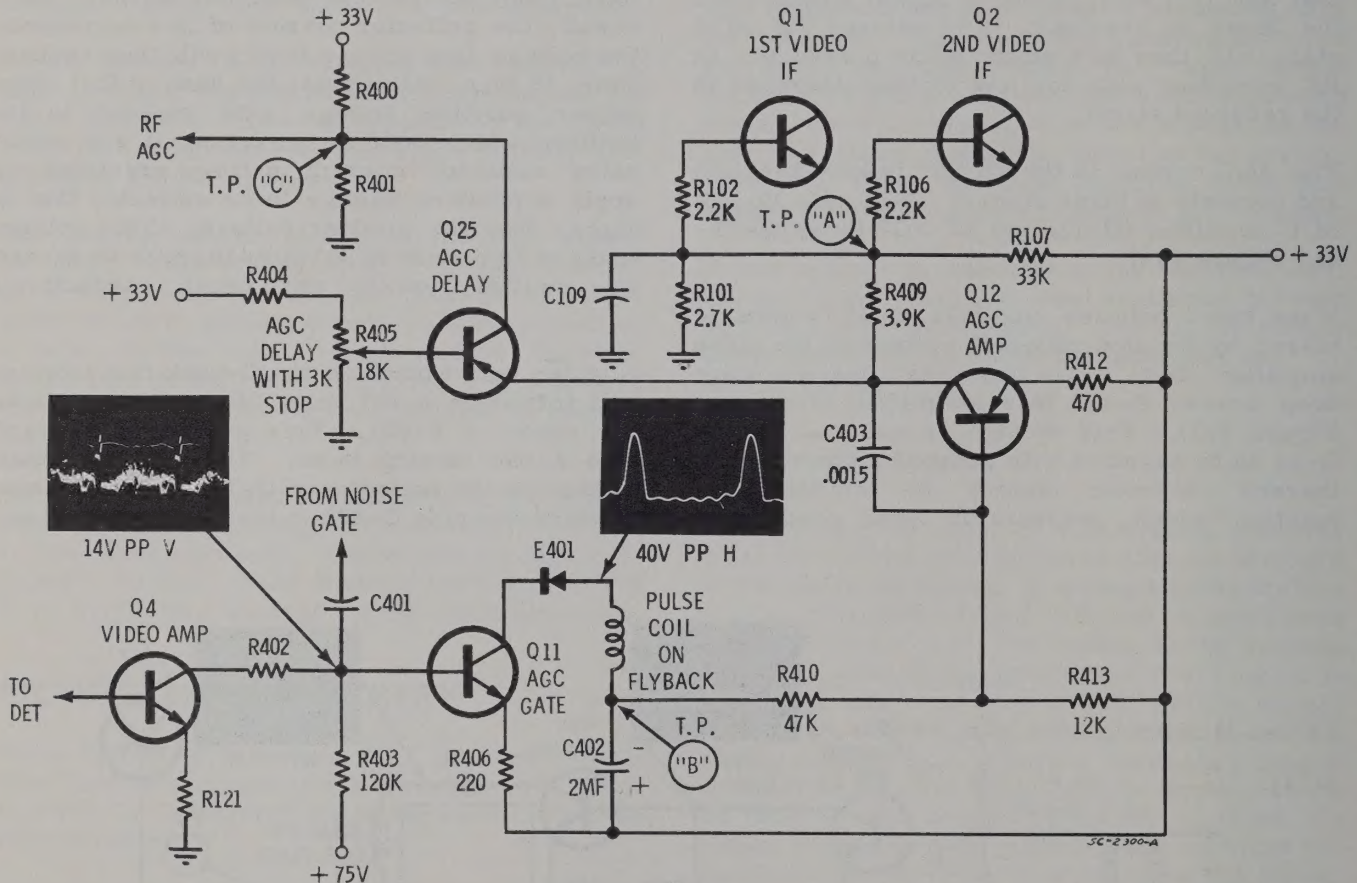

+ 33V
R400
RF AGC
T.P. "C"
R401
Q25 AGC DELAY
+ 33V
R404
AGC DELAY WITH 3K STOP
R405 18K
Q1 1ST VIDEO IF
Q2 2ND VIDEO IF
R102 2.2K
T.P. "A"
R106 2.2K
R107 33K
+ 33V
C109
R101 2.7K
R409 3.9K
Q12 AGC AMP
R412 470
C403 .0015
14V PP V
FROM NOISE GATE
E401
40V PP H
C401
Q4 VIDEO AMP
R402
TO DET
Q11 AGC GATE
PULSE COIL ON FLYBACK
R410 47K
R413 12K
T.P. "B"
C402 2MF
R403 120K
R406 220
R121
+ 75V
SC-2300-A

FIGURE 18 - COMPLETE AGC CIRCUIT

R-107 and R-101 form a voltage divider network to set up the required no signal base bias for Q-1 and Q-2. When Q-12 is forward biased by the negative going voltage developed at T.P. "B", its impedance lowers causing a larger voltage drop across voltage divider resistor, R-101.

This additional voltage supplements the existing +2.5 volt at T.P. "A" (IF AGC) thus the voltage at the IF AGC point will now increase to a more positive value. This positive voltage is than coupled to the base of Q-1 and Q-2 thru base current limiting resistors R-102 and R-106. The positive voltage on the base of the NPN IF transistors forward biases their emitter/base junction and affects a gain reduction by forward AGC.

The function of the AGC delay, Q-25, is to turn on and apply AGC to the RF amplifier just prior to signal overload in the tuner. This gives us the necessary RF AGC delay as previously explained.

The RF AGC delay (Q-25) is a PNP transistor and is held at cut-off by its base bias voltage divider network, R-405 and R-404. If the received signal is strong enough to cause approximately 4.5 volts to be developed at the IF AGC, Q-25 will then be forward biased by this voltage and turn on. The collector current of Q-25 will flow thru R-401 and cause T.P. "C" to become more positive. This positive voltage will be applied to the RF amplifier to affect a gain reduction. Any further increase in signal strength will result in RF amplifier gain reduction thus giving us the necessary RF AGC.

The RF AGC control (R-405) is adjusted at the factory and does not normally require readjustment. In the event it should, the following is a proposed method.

1. Turn AGC delay control fully clockwise (maximum RF AGC delay).

2. Tune receiver to a medium strength signal (snow free).

3. Turn AGC delay control slowly counterclockwise until noise (busy background) is just visible in picture, then turn control clockwise until noise on screen just disappears. The control is now adjusted.

TROUBLESHOOTING THE AGC, IF AND VIDEO AMPLIFIER CIRCUITRY

Troubles in a gated AGC system usually show up in one of two ways. Either the system is incapable of developing the necessary AGC voltage or it develops too much. The first is usually more common. With this condition, the receiver may operate normally if the input signal is reduced to a low enough value where no gain reduction is required. Any increase in signal will cause the picture to bend or disappear into a blank snow free raster.

With the second condition, the excessive AGC voltage will turn off the IF and/or tuner and it will be impossible to receive a signal.

Troubleshooting an AGC system may, at first glance, appear to be difficult since it is somewhat difficult to determine which problem is the cause and which is the effect.

For instance, distortion (bending or overload) might be caused by a defect in the IF amplifier itself or because it lacks sufficient AGC voltage. To determine which circuit actually contains a problem, measure the voltage at T.P. "B", then measure T.P. "A" and T.P. "C". These checks will indicate if the AGC system is working correctly.

1. Voltage measured at T.P. "B" should change from approximately +33 volts with no signal (tuner set between channels) to approximately 15 volts with a snow free signal.

2. Voltage at T.P. "A" should change from 2.5 volts (with no signal) to 4.5 volts (with signal).

3. Voltage at T.P. "C" should change from 3.2 volts (no signal) to 5 volts (with strong signal). Voltage measured at T.P. "C" will vary with setting of R-405, AGC delay control.

If the voltage at these test points are not correct, the next step is to determine the ability of the AGC gate (Q-11) to operate.

1. To turn Q-11 off, short emitter to base. The voltage at T.P. "A", "B" and "C" should read the same as with tuner set between channels.

2. To turn Q-11 on, short emitter to base on the video amplifier, Q-4. The voltage measured at T.P. "B" should now read 2 volts, T.P. "A" should read 6 volts and T.P. "C" should read 13 volts. (This test simulates a very strong signal.)

The voltages in the above two steps can also be used to determine if the AGC amplifier and RF delay stages are operating properly. Voltage and waveform measurements in the defective stages can then be used to determine the defective part.

When T.P. "B", "C" and "A" are measured and readings are normal, then a scope should be connected to the base of the video amplifier (Q-4). With a snow free picture, the signal at this point should be 2 volts peak to peak. To isolate a defective IF stage, measure collector voltages on Q-3, Q-2 and Q-1 both off and on channel and compare them to the schematic.

A quick check for troubleshooting the video amplifiers is to meter the base voltage on video amplifier (Q-4) with no signal. When noise gate (Q-13) and video amplifier (Q-4) are working correctly, R-120 should vary the base voltage (of Q-4) .5 of a volt above and below 3.4 volts.

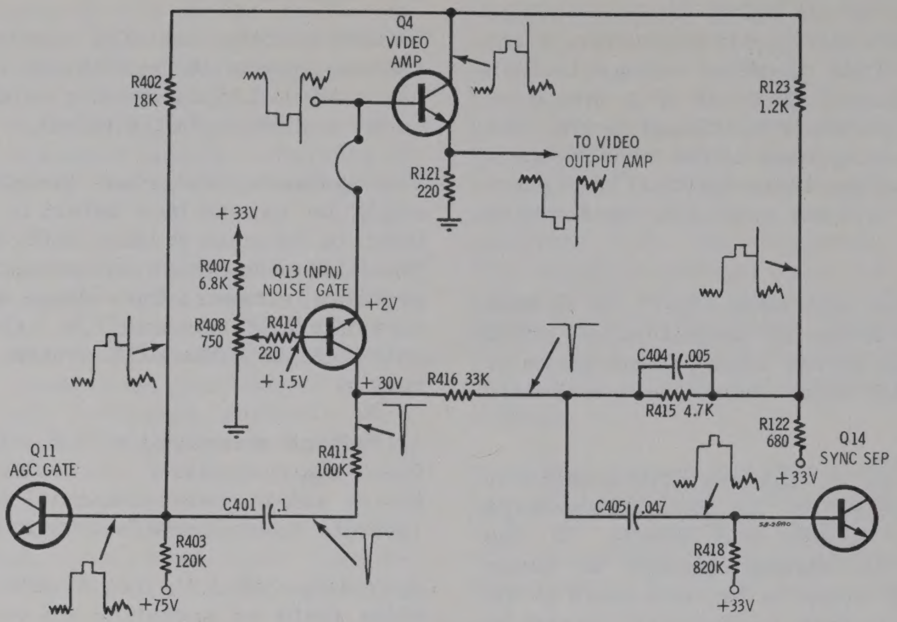


FIGURE 19 - NOISE GATE CIRCUITRY SHOWING EFFECTS DURING NOISE PULSE INTERVAL

Under zero signal conditions, R-120 should be adjusted for 25 volts at T.P. "D" (collector of video output, Q-5) with the contrast control at maximum.

NOISE GATE CIRCUIT

Because the AGC system samples the strength of the signal only during horizontal sync time, it is immune to noise interference at all other times. A properly adjusted noise gate circuit will help make the AGC system immune to noise even during horizontal sync time and will remove noise signals from the sync separator stage as well.

The circuit is shown in Figure #19.

Basically, the noise gate (sometimes called a noise inverter) is a transistor stage that is reverse biased so that normal amplitude video signals do not turn it on. When a noise pulse is received that is larger in amplitude than the sync signal, the stage conducts and makes an amplified negative going pulse from the noise. This negative pulse is fed to both the sync separator and the AGC stage and cancels the noise pulse.

The emitter of Q-13 is connected directly to the base of the video amplifier stage and has the same potential or approximately 2 volts when a signal is being received. The base of Q-13 is connected to an adjustable voltage source which is adjusted to provide approximately 1.5 volts to its base for normal operation. With these conditions, the stage is reverse biased or cut-off. The video signal from the first video stage is negative going which is the direction that will turn the noise gate stage on if the amplitude becomes large enough.

The noise gate control is adjusted so that the stage is reverse biased and the negative going horizontal sync pulses fed to the emitter do not have sufficient amplitude to turn the stage on. Any noise that is present on the sync pulse that is larger in amplitude than the pulse will drive the transistor on. The noise pulse only will be amplified in the collector circuit. The circuit configuration is common base hence no phase inversion occurs and the noise pulse in the collector circuit is negative going also.

The negative noise pulse is coupled thru C-401, .1mfd to the base of the AGC gate where it cancels the positive noise pulse in the signal from the video amplifier collector.

A reduced value of the negative noise pulse is developed at the junction of R-415 and R-416 which cancels the positive noise pulse in the signal from the video amplifier collector circuit.

Cancelling out noise pulses provides a measure of noise immunity for the AGC and sync separator stages.

Adjustment of this circuit is very simple. The receiver should be correctly tuned to the strongest channel to be received. Starting with the noise gate control maximum counter-clockwise (off), slowly rotate it clockwise until the picture starts to bend or fall out of sync. Then back up until the picture is stable.

Malfunctions in this circuit can cause picture tearing or bending that can easily be confused with AGC or sync trouble. Also, a defect in the noise gate circuit can prevent proper setting of video amplifier bias.

To eliminate the noise gate transistor as the

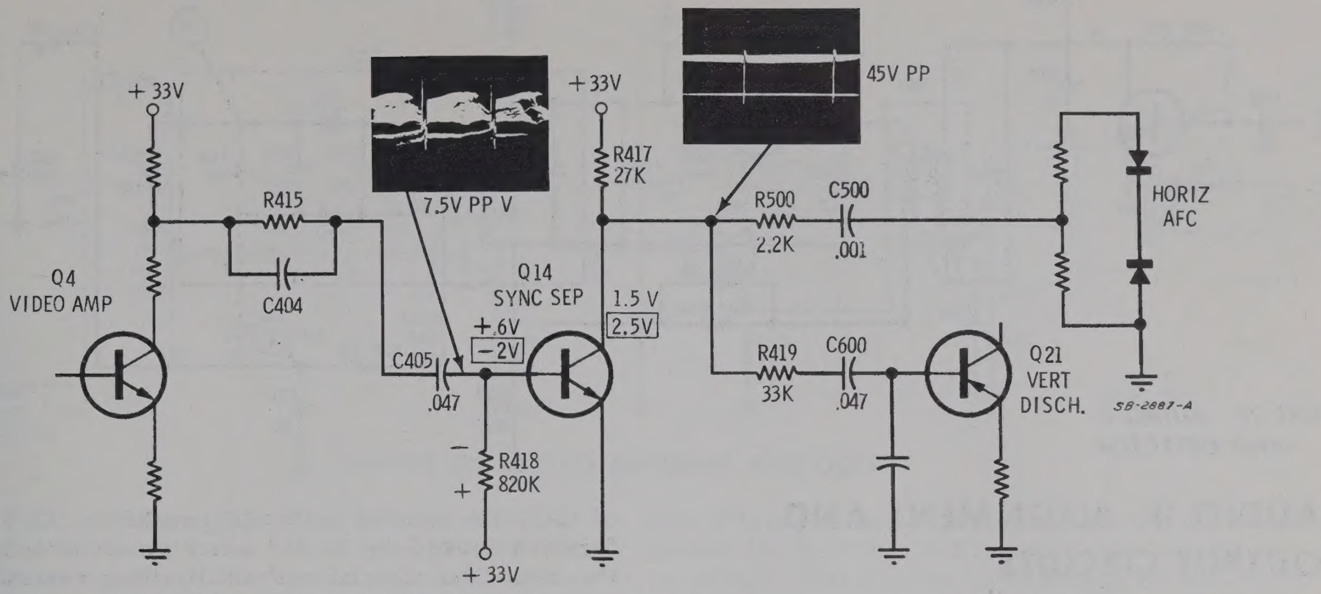


FIGURE 20 - SYNC SEPARATOR

source of a problem, it can be removed from the circuit by cutting the wire test loop in its emitter circuit. If the problem clears up, the noise gate circuitry (and adjustment) should be checked. If the problem persists after the test loop has been cut, other circuits should be analyzed to determine the source of the problem.

If the problem is in the noise gate circuit, it can be checked as follows. After reconnecting the wire test loop, the noise gate transistor can be checked for its ability to turn on and off as forward bias is increased or removed. Shorting the base and emitter together should provide a slight increase in collector voltage indicating that the transistor is not shorted and capable of being turned off.

The forward bias can be increased by bridging a resistor (approximately 27K) from 33 volts to the arm of the noise gate control and noting a decrease in collector voltage indicating that the transistor is not open and is capable of being turned on. However, this check is generally unnecessary since an open noise gate transistor will not generally be apparent in the picture performance on most signals and the only effect will be impared noise immunity on fringe signals.

SYNC SEPARATOR CIRCUIT

The sync separators' function is to receive the complete video signal and separate the sync pulses and discard all of the other information. For this application, a transistor operates very similar to a tube type sync separator. The circuit is shown in Figure #20.

Two sets of DC voltages are shown. The ones in boxes are with signal and the others are with the channel selector half-way between channels (no signal). These voltages are not exact since they can be affected by signal strength and video bias adjustment. They do, however, represent typical operation.

For no signal operation, R-418 forward biases the stage so that there is considerable collector current. This is evidenced by the large voltage drop across the collector load.

When a positive going signal is received from the video amplifier, the base is driven positive (by the composite video signal) as compared to the emitter.

This causes electrons to flow from the emitter to the base which charges C-405. After the sync leaves, C-405 will discharge thru R-418 causing the base to become negative. This is very similar to drawing grid current in a tube.

The stage now has considerable reverse bias. The positive sync tips are of sufficient amplitude to overcome the reverse bias and turn the transistor on for the duration of the pulse. During the conduction time, the base emitter current restores the negative charge on C-405 that was partially lost between sync pulses. This keeps a constant reverse bias on the sync separator stage.

During scan time (time between sync pulses), the stage is reverse biased and does not draw collector current so the video information is not reproduced in the collector. The higher amplitude sync information will drive the transistor "on" and the sync information will be reproduced in the collector but reversed 180°.

These pulses are adjusted for the proper amplitude and waveform by R-500, R-419 and fed to the horizontal and vertical sweep systems.

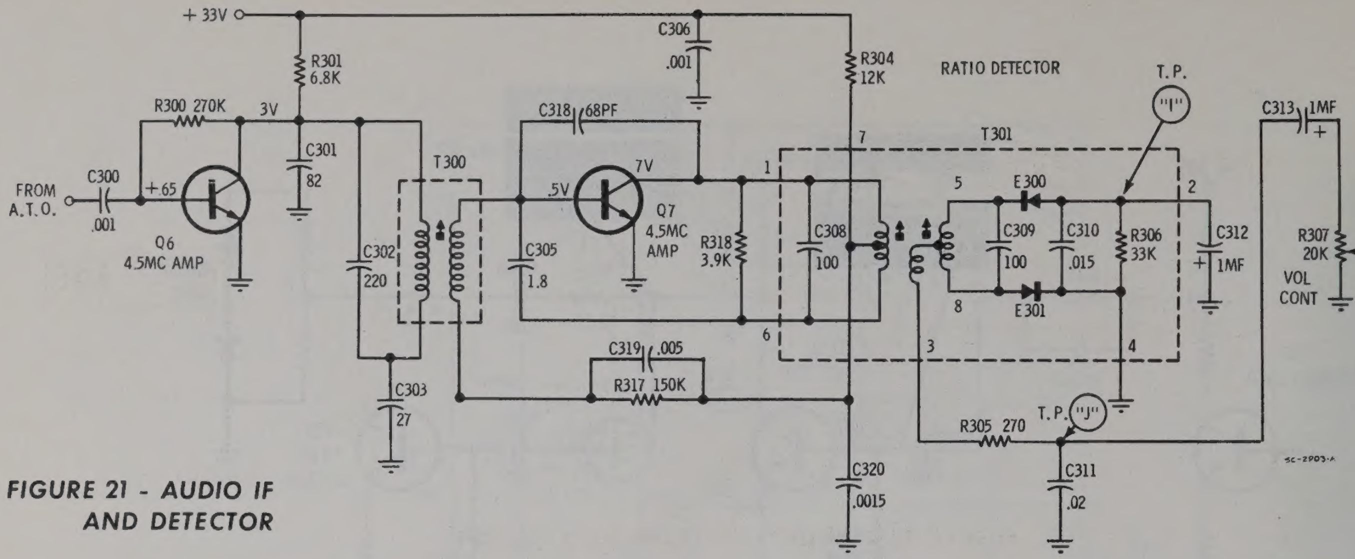

+33V
R301
6.8K
C306
.001
R304
12K
RATIO DETECTOR
T.P.
"I"
R300 270K
3V
C318
68PF
T301
C313
1MF
C301
82
T300
7V
1
7
5
E300
2
FROM
A.T.O.
C300
.001
+.65
Q6
4.5MC AMP
.5V
Q7
4.5MC
AMP
C302
220
C305
1.8
R318
3.9K
C308
100
C309
100
C310
.015
R306
33K
C312
1MF
R307
20K
VOL
CONT
TO
AUDIO
AMP
8
E301
6
3
4
C319
.005
R317 150K
C303
27
R305 270
T.P.
"J"
C320
.0015
C311
.02
SC-2903-A

FIGURE 21 - AUDIO IF AND DETECTOR

AUDIO IF, ALIGNMENT AND OUTPUT CIRCUITS

AUDIO IF AND DETECTOR CIRCUITS

The 4.5Mc sound take-off transformer, T-100, is in the emitter circuit of the video amplifier stage. The signal developed across this transformer is coupled by C-300 to the base of Q-6, a common emitter 4.5Mc sound IF amplifier (see Figure #21). Q-6 is forward biased by R-300. This resistor also supplies feed-back from collector to base for stabilization.

The second 4.5Mc amplifier stage is designed to oscillate at a frequency very close to 4.5Mc. The 4.5Mc input signal controls the frequency of its oscillation. The advantage of having the stage oscillate becomes apparent on weak signals because audio signals to weak to be heard above the noise level are strong enough to control the oscillations and result in a usable FM output signal.

Feed-back to provide oscillation is provided by C-319, C-318 and R-317. C-320 does not afford complete by-passing of collector resistor R-304 and the output signal developed across C-320 is coupled back to the input.

T-300 in the collector circuit of Q-6 is resonant at 4.5Mc to couple maximum signal to the base of Q-7, the second 4.5Mc IF amplifier. Q-7 is forward biased by R-317 which is connected to the collector side of current limiting resistor, R-304. R-317 also provides stabilization. R-318 is a parasitic suppressor that lowers the "Q" of the collector circuit to prevent oscillations.

The ratio detector diodes are located inside T-301, the ratio detector transformer. The cover of this transformer is removable for easy testing or diode replacement.

AUDIO ALIGNMENT PROCEDURE

1. Tune in a medium strength (snow free) signal and reduce sound by adjusting fine tuning toward smear (less detail in picture).

2. Connect a pair of 100K resistors in series from T.P. "I" to chassis as shown in Figure #22.

3. With a VTVM, adjusted to "zero center scale" and "low DC range", connect its positive lead to the junction of the two 100K resistors. Connect the negative lead to T.P. "J".

4. Slightly misadjust secondary (bottom slug) of the ratio detector (T-301) and observe direction of meter movement. Leave slug in this position.

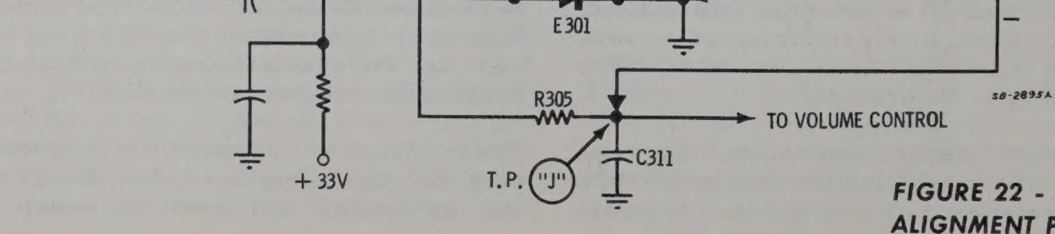
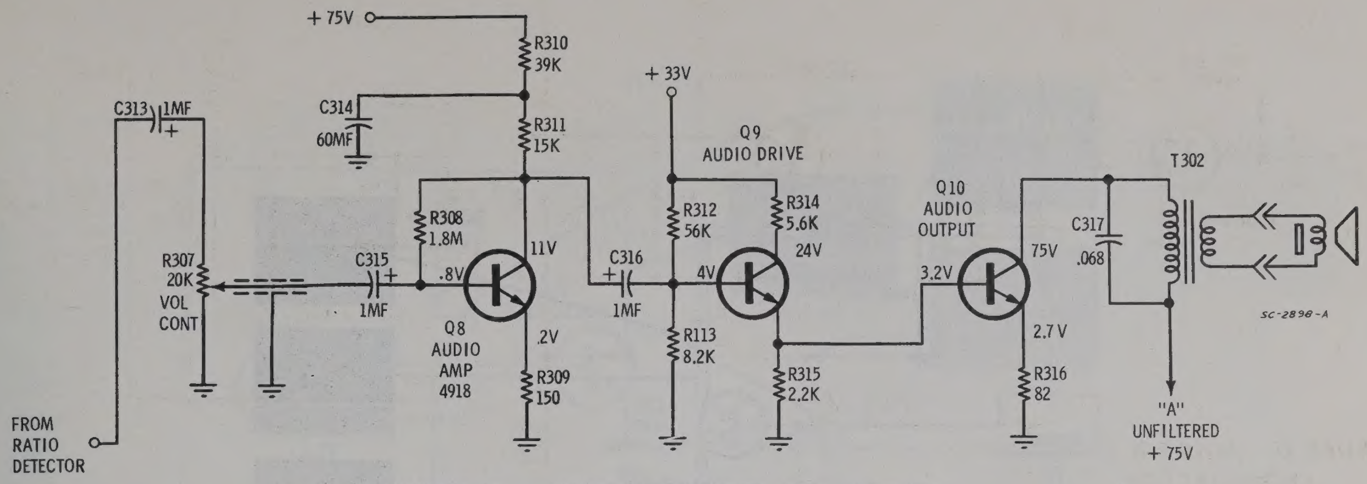

T.P.
"I"
T301
E300
100K
C310
.015
R306
33K
C310
1MF
100K
+
DC
VTVM
CENTER
ZERO
−
E301
R305
TO VOLUME CONTROL
+33V
T.P.
"J"
C311
SB-2895A

FIGURE 22 - AUDIO ALIGNMENT PROCEDURE



+75V
R310 39K
+33V
C313 1MF
C314 60MF
R311 15K
Q9 AUDIO DRIVE
T302
R308 1.8M
R312 56K
R314 5.6K
Q10 AUDIO OUTPUT
C317 .068
R307 20K VOL CONT
C315 1MF
11V
C316 1MF
24V
75V
.8V
4V
3.2V
Q8 AUDIO AMP 4918
.2V
R113 8.2K
2.7V
R309 150
R315 2.2K
R316 82
"A" UNFILTERED +75V
FROM RATIO DETECTOR
SC-2898-A

FIGURE 23 - AUDIO AMPLIFIER AND OUTPUT

5. Adjust primary (top slug) of ratio detector, sound IF (T-300) and 4.5Mc trap (T-100) for maximum meter deflection from zero center scale and in the same direction as in Step #4.

6. Adjust secondary (bottom slug) for zero center scale.

7. If 4.5Mc is visible in picture when properly fine tuned, it becomes necessary to slightly adjust the 4.5Mc trap (T-100) for minimum 4.5Mc in the picture.

A second method for aligning the sound IF coils is:

1. Reduce the sound signal by tuning toward smear (less detail in picture) on a snow free picture.

2. Adjust T-301, T-300 and T-200 for best audio with minimum noise as judged by listening to the output.

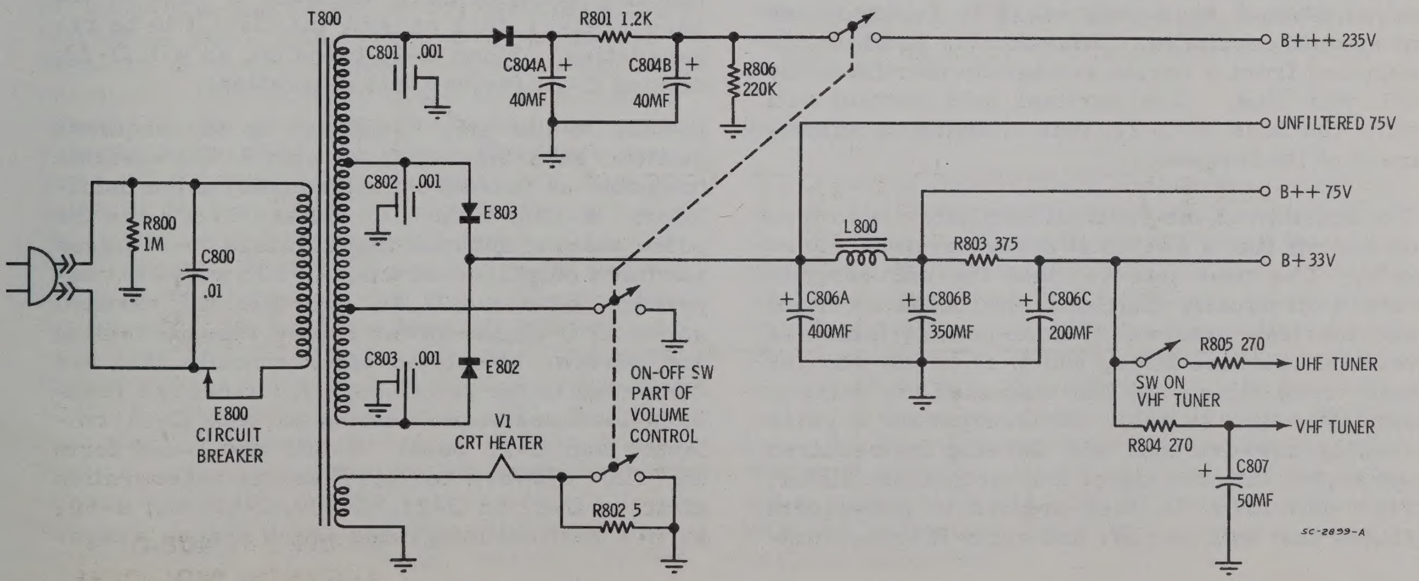
AUDIO AMPLIFIER AND OUTPUT

The output of the ratio detector is fed through the volume control to the audio amplifier, Q-8 (see Figure #23). This transistor is forward biased by R-308. R-311 and C-314 supply decoupling. Output from Q-8 is coupled by C-316 to the base of Q-9, the audio driver. Q-9 is connected as a common collector and is forward biased by R-312 and R-313. Q-9 also effects an impedance match between the high collector impedance of Q-8 and low base to emitter impedance of Q-10. The audio signal is taken from the emitter circuit of Q-9 and directly coupled to the base of Q-10. Forward bias for Q-10 is supplied by the emitter voltage of Q-9. R-309 and R-316 emitter resistors provide stabilization for Q-8 and Q-10 respectively.

NOTE: Volume control should be kept at minimum when speaker is disconnected to prevent possible damage to the output transistor.

POWER SUPPLY CIRCUIT

The transformer power supply consists of a full wave rectifier circuit with filter choke supplying 75 volts (B++) and 33 volts (B+), plus a half-wave circuit supplying 235V (B+++ - see Figure #24). The power supply uses a 1.23 ampere circuit breaker in the primary winding



T800
R801 1.2K
C801 .001
C804A 40MF
C804B 40MF
R806 220K
B+++ 235V
UNFILTERED 75V
B++ 75V
C802 .001
E803
R800 1M
C800 .01
L800
R803 375
B+33V
C806A 400MF
C806B 350MF
C806C 200MF
R805 270
UHF TUNER
C803 .001
E802
ON-OFF SW PART OF VOLUME CONTROL
SW ON VHF TUNER
VHF TUNER
E800 CIRCUIT BREAKER
V1 CRT HEATER
R804 270
C807 50MF
R802 5
SC-2899-A

FIGURE 24 - POWER SUPPLY

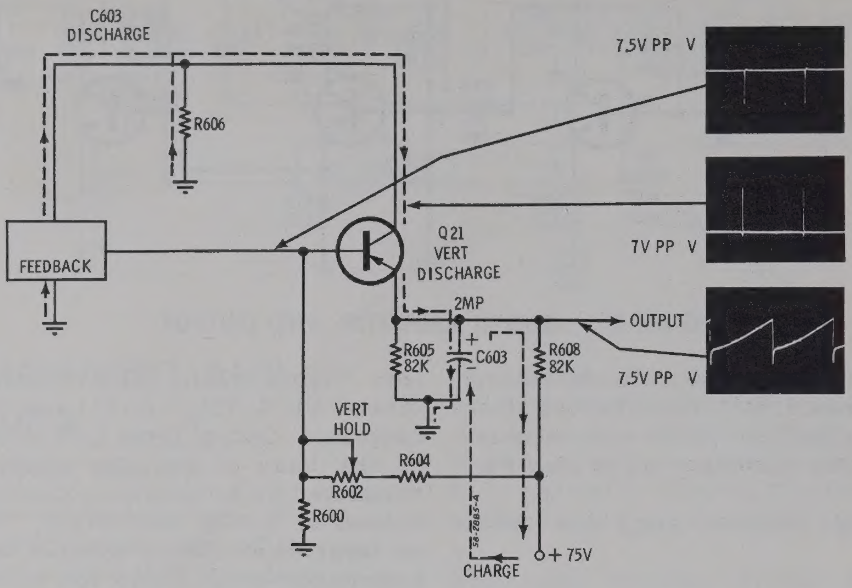


FIGURE 25 - SIMPLIFIED VERTICAL OSCILLATOR

of the transformer for current overload protection. The CRT heaters are pre-warmed by a small amount of current flow through R-802 when the set is turned off. CAUTION SHOULD BE USED WHEN TROUBLESHOOTING THE SET IN THIS CONDITION AS THE POWER SUPPLY IS STILL IN OPERATION UNTIL THE AC LINE CORD IS REMOVED.

VERTICAL SWEEP SECTION

VERTICAL OSCILLATOR

Figure #25 is a simplified diagram of the vertical oscillator in the TS-458. The vertical discharge transistor (Q-21) acts like a switch and an additional feed-back stage is incorporated to sustain oscillation. Bias for the oscillator is supplied from a series voltage divider from the +75 volt line. The vertical hold control will vary the bias of Q-21, thus allowing an adjustment of its frequency.

The function of the vertical oscillator is to turn on and off like a switch at predetermined intervals. The time interval that the oscillator is turned off usually indicates vertical trace time; and the time interval it is on usually indicates vertical retrace time, which is much shorter than trace time. At the output of the vertical oscillator (or switch), we incorporate a pulse shaping network that will develop the required waveform with the aid of the vertical oscillator. This waveform is then applied to subsequent stages that will amplify and apply it to the vertical deflection coils for scanning of the electron beam vertically.

Figure #26 is a complete drawing of the vertical oscillator in the TS-458 (with waveform analysis) consisting of a two stage transformless blocking oscillator. The feed-back loop is direct and does not employ any capacitors or transformers. The vertical discharge transistor (Q-21) performs the same function as a switch that will turn on at predetermined intervals, discharging capacitor C-603 and initiating vertical retrace. Q-22 performs almost the same function as the transformer did in the vertical blocking oscillator. A positive pulse from the collector of Q-21 is applied to the base of Q-22. Q-22 then steps up and inverts this pulse (similar to a blocking transformer), applying it back to the base of Q-21, thus causing the circuit to be regenerative. When Q-21 turns on, so will Q-22, driving Q-21 further into saturation.

R-604, R-602 and R-600 set up the required emitter/base bias of Q-21 with R-602 variable to enable us to control the frequency of the oscillator. R-605, C-603, R-604 and R-608 are the pulse shaping network that develops the required sawtooth output waveform. C-602 works in conjunction with R-607 to decouple the vertical sawtooth from the power supply, thus preventing any adverse effects to other circuits that are connected to the power supply. R-606 is a feedback load resistor common to both Q-21 collector and Q-22 base. R-603 and L-600 form an "LR" network to increase the regeneration effect of Q-22 on Q-21. C-600, C-601 and R-601 form a vertical integrator which shapes a nega-

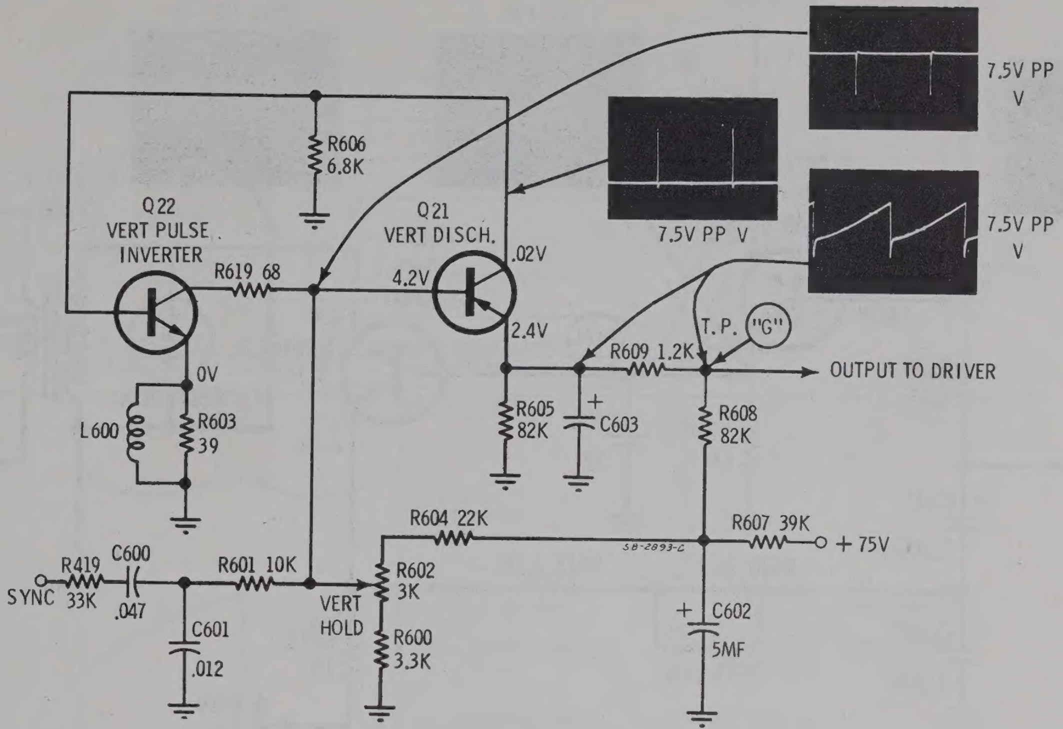


FIGURE 26 - COMPLETE VERTICAL OSCILLATOR CIRCUIT

tive vertical sync pulse and applies it to the base of Q-21. This pulse prematurely forward biases Q-21 with respect to its free running frequency and initiates vertical retrace, thus synchronizing the frequency of the vertical oscillator with the station.

When power is applied to the circuit, the sawformer capacitor, C-603, begins to slowly charge up positive thru R-607, R-608 and R-609 (consisting of approximately 130K ohms resistance). Q-22 and Q-21 are biased to cut off at this time by the charging current of C-603, and the picture is scanned vertically from top to bottom. At the bottom of the raster, C-603 attains a charge of sufficient amplitude to forward bias Q-21 turning it on. The instant Q-21 turns on, it develops a positive pulse across R-606 load resistor. This positive pulse is then directly coupled to the base of Q-22 and has the proper polarity to forward bias its emitter/base junction. Q-22 then turns on causing a negative pulse to be developed in its output by virtue of the voltage drop across R-602 and R-604. This negative pulse is directly coupled to the base of Q-21, hence further turning it on into saturation and lowering its collector to emitter impedance to a fraction of an ohm. The low impedance from emitter/base of Q-22 and collector/emitter of Q-21 effectively shorts out C-603, thus discharging it. The discharge of C-603 initiates vertical retrace and forces the beam back up to the top of the picture very rapidly. If you will note, C-603 is charged thru a high resistance (approximately 130K) during vertical trace, allowing a relatively long time to scan the screen during this interval but discharged thru a low resistance during vertical retrace, allowing a relatively short time to return the beam back to the top of the screen. The discharge of C-603 causes the emitter of Q-21 to become less positive. (NOTE: This is a decrease in emitter/base forward bias of Q-21.) This, in turn, decreases its collector current which lowers the amplitude of the positive pulse on its collector to such an amplitude that will bias Q-22 toward cut-off. Q-22's collector voltage will now rise positive. This positive voltage is coupled over to the base of Q-21. This reverse biases Q-21 cutting it off. Both transistors will now stay cut-off until C-603 charges up to a value that will forward bias and turn on Q-21, thus repeating the sequence.

VERTICAL OUTPUT

The task of the vertical amplifiers is to increase the level of driving signal generated by the vertical oscillator to a level which is sufficient for driving the vertical deflection coils. The amplifier must be near Class "A" operation to amplify the sawtooth without distortion. The load that the vertical output transformer looks into is low; therefore, with the low collector resistance added to the low impedance load, we do not have a purely inductive circuit. We must apply a sawtooth of voltage to the output to produce a sawtooth of current thru the vertical deflection coils to achieve a linear vertical deflection.

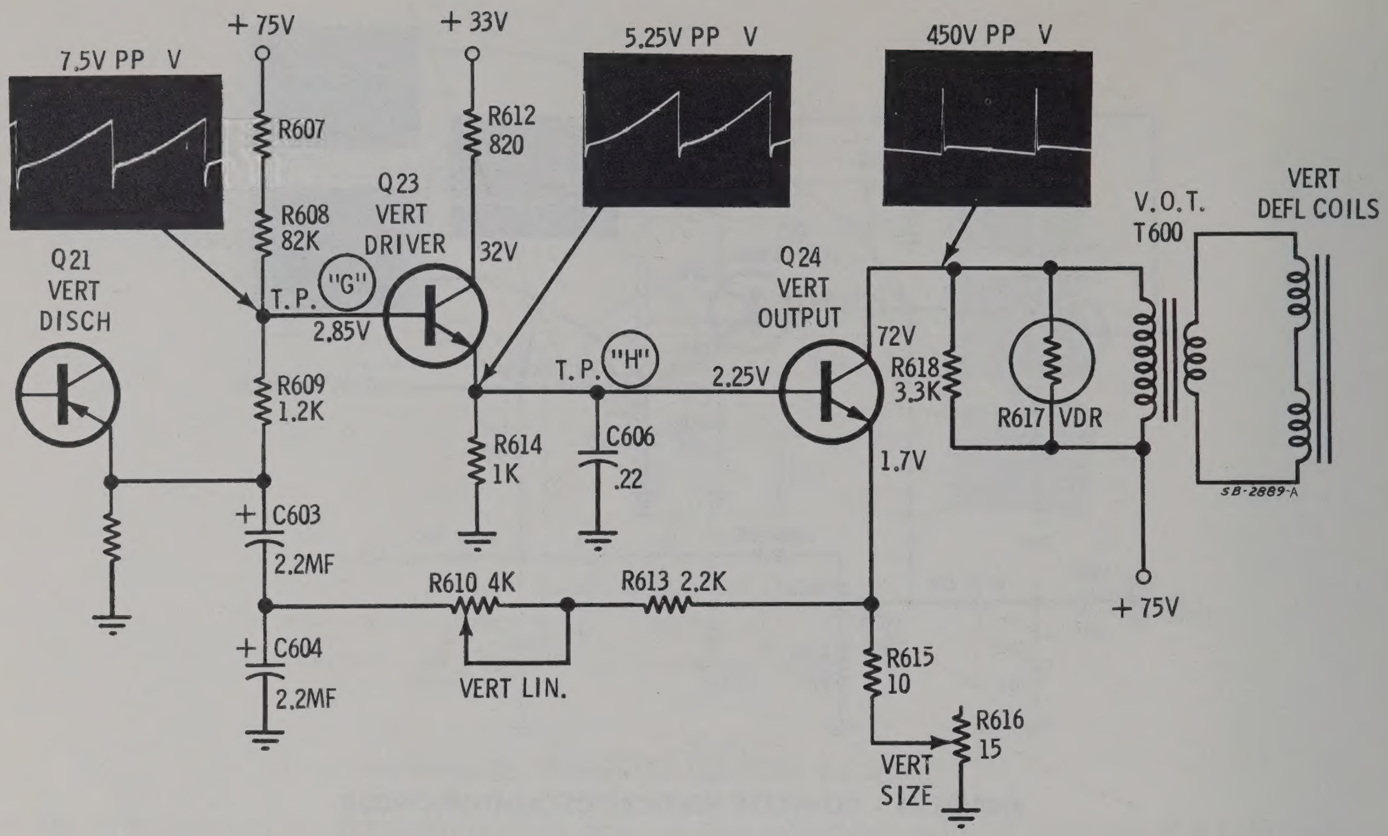

+ 75V
+ 33V
7.5V PP V
5.25V PP V
450V PP V
R607
R608
82K
R612
820
Q23
VERT
DRIVER
32V
Q21
VERT
DISCH
T.P.
"G"
2.85V
R609
1.2K
T.P.
"H"
R614
1K
C606
.22
Q24
VERT
OUTPUT
2.25V
72V
R618
3.3K
R617
VDR
1.7V
V.O.T.
T600
VERT
DEFL COILS
SB-2889-A
C603
2.2MF
C604
2.2MF
R610 4K
R613 2.2K
VERT LIN.
R615
10
R616
15
VERT
SIZE
+ 75V

FIGURE 27 - VERTICAL OUTPUT

In Figure #27, the vertical driver, Q-23 (acting as an emitter follower), and vertical output, Q-24, amplify the vertical sawtooth waveform from the oscillator to a level suitable for driving the deflection coils. R-608 sets the base bias of Q-23 and also acts as its base load resistor. R-612 is a collector current limiting resistor for Q-23. R-614 is the emitter load resistor for Q-23. Q-24 receives its emitter/base forward bias from the emitter of Q-23. We can see that DC coupling is employed from the vertical oscillator to the vertical output.

R-615 and R-616 form a self-bias network for Q-24 with R-616 (vertical size) adjustable. The vertical size control will vary the amount of degeneration in the emitter circuit of the vertical output stage.

When the driving signal at the base of Q-24 goes negative, vertical retrace will be initated. At the instant of vertical retrace, a high positive reactive pulse is introduced to the collector of Q-24. This pulse occurs due to the abrupt turn off of Q-24 by the driving sawtooth on its base. During the time Q-24 was turned on, a large magnetic field was built around T-600 and the vertical deflection coils, then when Q-24 is cut off, this field collapses and causes a large self-induced voltage to be produced in the form of a positive pulse at the collector of Q-24. This positive pulse could exceed the collector/emitter peak inverse voltage rating of Q-24 and destroy it. The amplitude of this pulse is inversely proportional to the turn off time of Q-24 (if "turn off time" is short, pulse is large in amplitude), therefore, by increasing the "turn off time" of Q-24, we can reduce the amplitude of this positive pulse to a safe value.

By connecting a capacitor (C-606) from the base to chassis of Q-24, we affect a reduction in amplitude of this positive pulse. C-606 will oppose an abrupt change in voltage (this is an inherent characteristic of a capacitor) hence, increasing "turn off time" of Q-24 which, in turn, will reduce the amplitude of the positive pulse at its collector to a safe value. However, in the event this positive pulse on the collector does approach this collector to emitter breakdown voltage, a VDR (voltage dependent resistor) R-618 is inserted across the primary of the vertical output transformer. The resistance of the VDR varies inversely with the voltage across it thus further limiting the positive pulse on the collector of the vertical output transistor to a safe value.

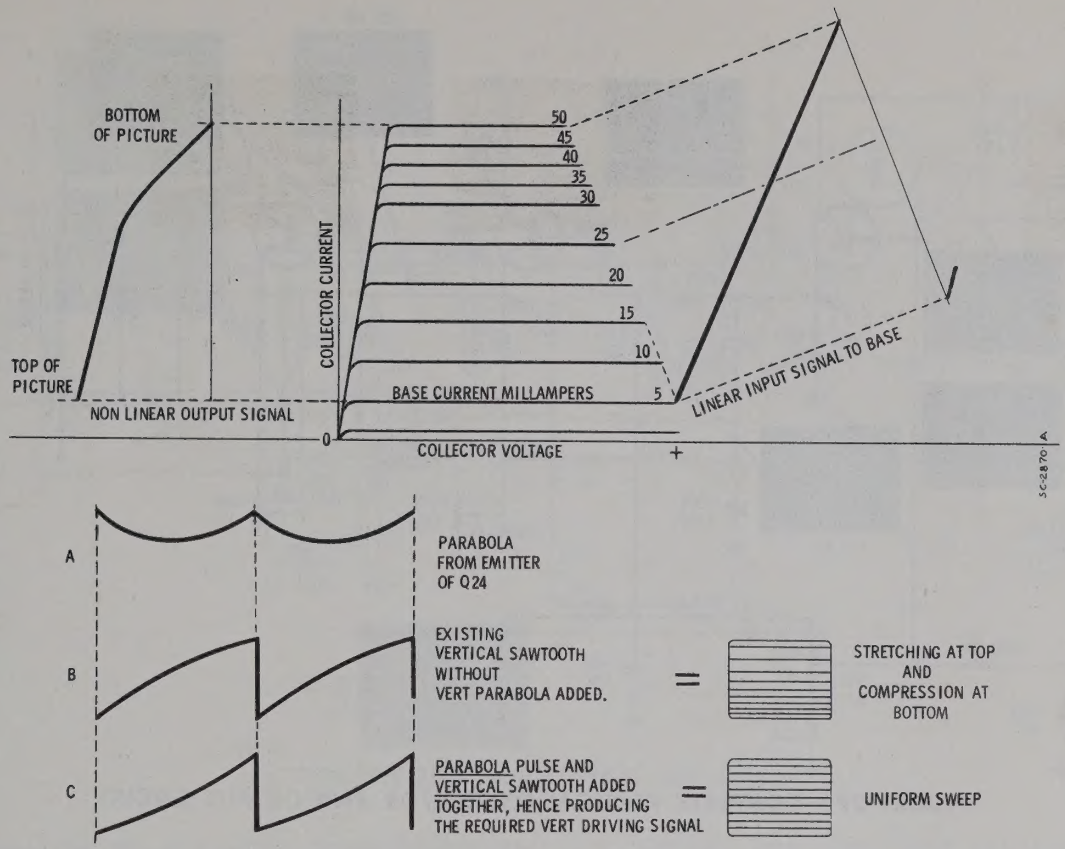

BOTTOM OF PICTURE
TOP OF PICTURE
NON LINEAR OUTPUT SIGNAL
COLLECTOR CURRENT
50
45
40
35
30
25
20
15
10
5
BASE CURRENT MILLAMPERS
0
COLLECTOR VOLTAGE
+
LINEAR INPUT SIGNAL TO BASE
SC-2870 A
A
PARABOLA FROM EMITTER OF Q24
B
EXISTING VERTICAL SAWTOOTH WITHOUT VERT PARABOLA ADDED.
=
STRETCHING AT TOP AND COMPRESSION AT BOTTOM
C
PARABOLA PULSE AND VERTICAL SAWTOOTH ADDED TOGETHER, HENCE PRODUCING THE REQUIRED VERT DRIVING SIGNAL
=
UNIFORM SWEEP

FIGURE 28 - VERTICAL OUTPUT TRANSISTOR CURVE

In order to achieve the desired power from the vertical output transistor, it must be driven into its non-linear modes. These non-linear areas of the transistor produces adverse effects on the linearity of the vertical scan.

Figure #28 is a typical "Ic" "Ec" transistor characteristic curve. It should be noted that as the forward current (or emitter/base bias) increases, the beta ($\frac{\Delta IC}{\Delta IB}$), or gain of the transistor decreases. Conversely, as the forward current decreases, the beta increases and remains rather constant until we get near cut off. Since the beta of this transistor varies as a function of driving signal, the output will not be a replica of the input. This is illustrated in Figure #28.

If this output current was applied to the vertical deflection yoke, severe stretching at the top and compression at the bottom of the raster would occur. In order to counteract this, we apply a concave sawtooth to the base of the output transistor.

To develop this concave sawtooth, we take a portion of the vertical sawtooth in the emitter circuit of Q-24 and couple it back to the wave shaping network C-603 and C-604 via R-610 (vertical linearity control) and R-613. C-604 integrates this sawtooth into a parabola and adds it to the existing sawtooth developed by the oscillator to produce a more uniform vertical sweep. The amount of parabola added to the sawtooth waveform is governed by the setting of the vertical linearity control. Depicted in Figure #28 is an illustration of the effect of adding the vertical parabola to the existing vertical sawtooth wave.

The vertical driver, Q-23, receives a vertical sawtooth from the high impedance pulse shaping network (consisting of R-607, R-608, R-609, C-603 and C-604), strengthens this sawtooth and applies it to the low impedance vertical output Q-24 base/emitter circuit. Q-23 is an emitter follower which inherently has a high input impedance and low output impedance. This presents a high impedance load to the pulse shaping network and a low impedance load to the vertical output transistor base, thus affecting an impedance match. Q-24 receives this amplified signal and further amplifies it for driving the vertical deflection coils.

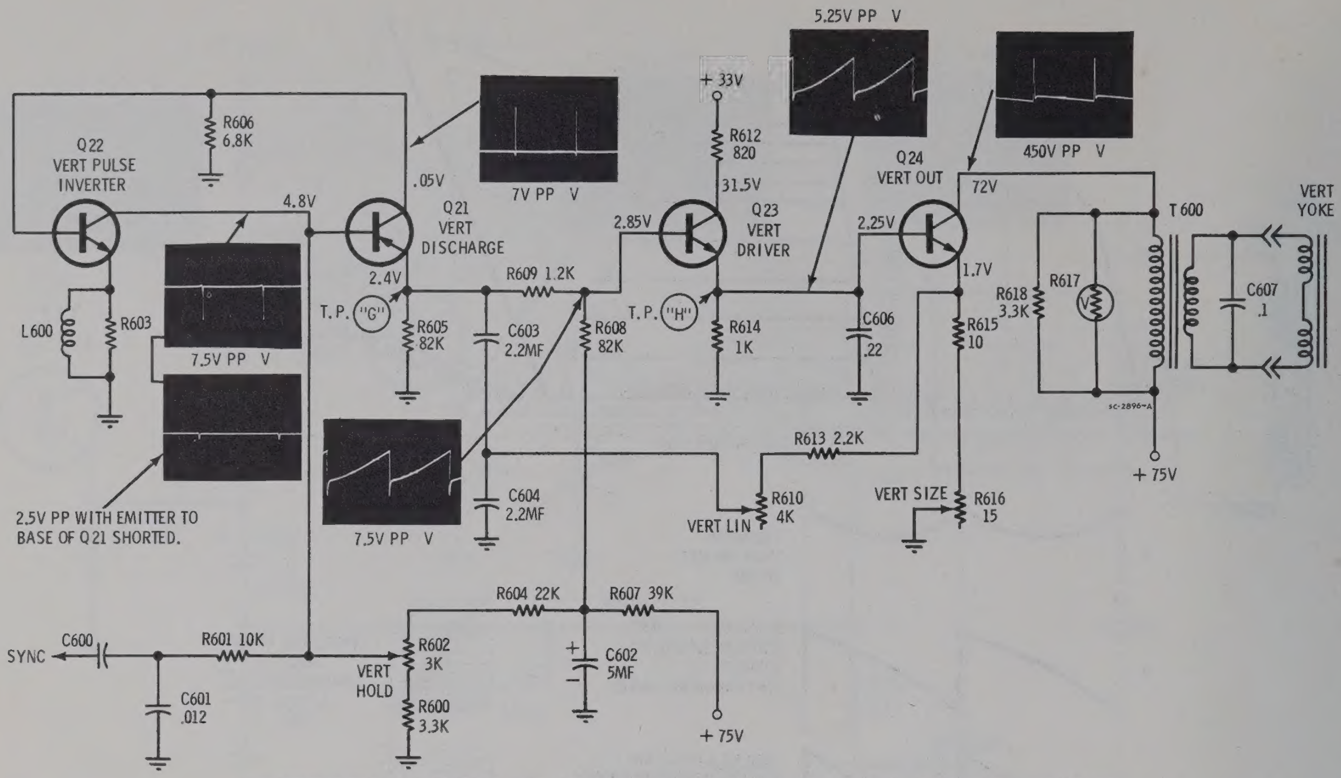

5.25V PP V
+ 33V
R612
820
31.5V
Q23
VERT
DRIVER
2.85V
T.P. "H"
R614
1K
Q24
VERT OUT
450V PP V
72V
2.25V
1.7V
T 600
VERT
YOKE
R617
R618
3.3K
R615
10
C606
.22
C607
.1
sc-2896-A
+ 75V
R613 2.2K
R610
4K
VERT LIN
VERT SIZE
R616
15
R606
6.8K
Q22
VERT PULSE
INVERTER
.05V
7V PP V
Q21
VERT
DISCHARGE
4.8V
2.4V
R609 1.2K
T.P. "G"
R605
82K
C603
2.2MF
R608
82K
L600
R603
7.5V PP V
2.5V PP WITH EMITTER TO
BASE OF Q21 SHORTED.
C604
2.2MF
7.5V PP V
R604 22K
R607 39K
SYNC
C600
R601 10K
R602
3K
VERT
HOLD
C601
.012
R600
3.3K
C602
5MF
+ 75V

FIGURE 29 - COMPLETE VERTICAL OSCILLATOR AND OUTPUT CIRCUIT

TROUBLESHOOTING THE VERTICAL SWEEP CIRCUITS

When analyzing a receiver with no vertical sweep, the defect should first be isolated to either vertical oscillator, driver or output stage. Due to the DC coupling between these stages, it is possible for a defective driver or output stage to disable the oscillator. Therefore, it may be necessary to open the base lead of these stages to help determine which stage is defective (see Figure #29).

The base lead of the vertical output can be easily opened either where it connects to the etched board, T.P. "H" or at the output transistor, Q-24. With this lead open, an oscilloscope can be used to check for the presence of vertical sawtooth driving voltage from the driver, Q-23. (NOTE: With the output disabled, this waveform will have an exponential rise time rather than sawtooth due to the lack of feed-back from the output (Q-24) emitter circuit.)

If this driving voltage is present, the output stage must be defective. If no vertical sawtooth is present from the driver, either oscillator or driver is defective. By opening the base lead of the driver, a scope can be used to isolate the defect to either the oscillator or driver. If a vertical sawtooth is present at T.P. "G", the driver stage is defective. If no sawtooth is present, the oscillator is defective. Reverse bias measured with a VTVM between emitter and base of the vertical discharge (Q-21) is also a good indication that the oscillator is functioning.

Once the defective stage has been isolated, voltage measurements can be used to determine the defective components. Emitter voltage readings of the individual stages will usually locate a defective transistor. However, due to the DC coupling between stages, an unusual emitter voltage reading may be caused by a preceeding stage being defective.

HORIZONTAL SWEEP SYSTEM

HORIZONTAL AUTOMATIC FREQUENCY CONTROL

Since the horizontal oscillator is susceptible to noise pulses and other types of interference, it would not be proper to directly control it by the arriving horizontal sync pulses. Therefore, an AFC network is incorporated ahead of the horizontal oscillator to control it.

The function of this AFC circuit is to develop a control voltage for syncronizing the horizontal oscillator with the incoming sync pulses. To accomplish this, the phase of the oscillator and sync are compared in the AFC circuit. If the oscillator is in phase with the sync, there will be no correction voltage developed. If the oscillator deviates in phase with respect to the sync, the correction voltage will now increase to a value that is proportional to the amount the oscillator deviated. This voltage is applied to the oscillator to pull the oscillator back in phase lock with the sync.

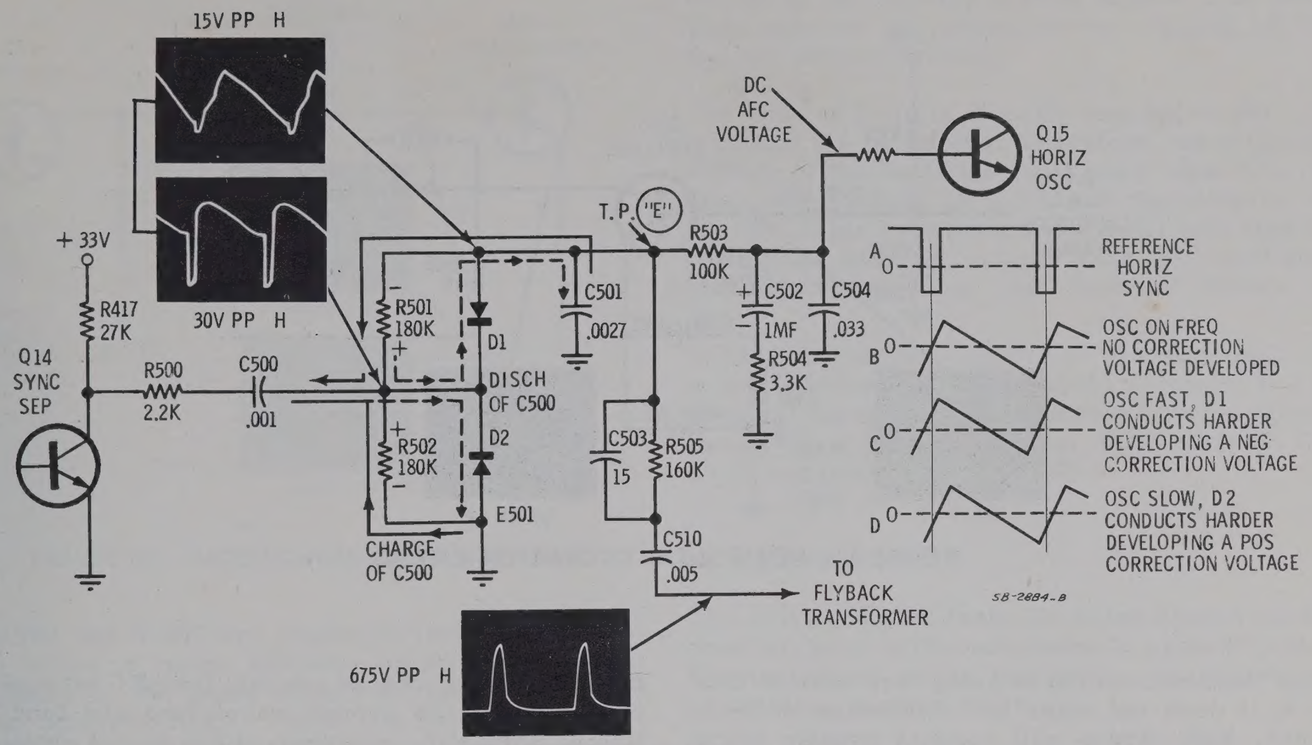

15V PP H
30V PP H
+ 33V
R417
27K
Q14
SYNC
SEP
R500
2.2K
C500
.001
R501
180K
D1
DISCH
OF C500
R502
180K
D2
E501
CHARGE
OF C500
C501
.0027
T.P. "E"
R503
100K
C503
15
R505
160K
C510
.005
C502
1MF
R504
3.3K
C504
.033
DC
AFC
VOLTAGE
Q15
HORIZ
OSC
A
REFERENCE
HORIZ
SYNC
B
OSC ON FREQ
NO CORRECTION
VOLTAGE DEVELOPED
C
OSC FAST, D1
CONDUCTS HARDER
DEVELOPING A NEG
CORRECTION VOLTAGE
D
OSC SLOW, D2
CONDUCTS HARDER
DEVELOPING A POS
CORRECTION VOLTAGE
TO
FLYBACK
TRANSFORMER
675V PP H
58-2884-B

FIGURE 30 - HORIZONTAL AFC CIRCUIT

By studying the TS-458 AFC circuit in Figure #30, you will note that it is almost identical to the AFC circuit employed in present Motorola tube receivers. Also included in Figure #30 is a set of waveforms which indicate the phase relationship between the oscillator and sync for different phases of the oscillator.

The phase detector diodes, D-1 and D-2, are connected back to back and encapsulated in a single plastic case identical to the existing Motorola silicon transistor cases. R-501 and R-502 form part of the output load of which our control voltage will be developed across. R-500 and C-500 are used to couple the horizontal sync into the phase detector to establish a reference phase to compare to the oscillator. The capacity of C-500 is made small so as to differentiate the vertical serrated sync pulses, thus coupling only horizontal sync to the AFC network. C-510, C-503, R-505 and C-501 integrate and couple a positive pulse from the flyback transformer (this pulse is a representation of the oscillator frequency) into the phase detector for frequency comparison with the sync. R-503, C-502, R-506 and C-504 form the horizontal anti-hunt network, thus preventing any AC from entering the horizontal oscillator and causing it to be unstable.

To explain the operation of the AFC circuit, we will begin with the sync separator stage (Q-14). Prior to the arrival of the sync pulse at the base of Q-14, it is cut off and has a high collector voltage. Since C-500 is connected to the collector of Q-14, it will be charged up to nearly the supply voltage. When a sync pulse turns on the sync separator, its collector voltage decreases. C-500 will now discharge coupling the sync to the cathodes of D-1 and D-2. This discharging voltage will forward bias both diodes (D-1 and D-2) causing them to conduct simultaneously. If the negative sawtooth on the anode of D-1 is going thru zero at this time (this is indicative of the oscillator being in phase with the sync), both diodes will conduct equally since both D-1 and D-2 anodes are zero. After the sync leaves the base of Q-14, its collector voltage rises. C-500 will now recharge causing a voltage drop across the two load resistors (R-501 and R-502) as indicated in Figure #30. Since both diodes conducted equally, equal and opposite voltages will be set up across the two resistors when C-500 recharges. This being the case, the net voltage across the two resistors will be zero and no correction voltage will be developed for the oscillator.

If the sawtooth on the anode of D-1 is not going thru zero when the sync arrives (this is indicative of the oscillator being out of phase with the sync), the conduction of the latter was influenced by the sawtooth on its anode. Now when the sync pulse leaves and C-500 recharges, the voltages developed across the load resistors are still opposite but not equal. Thereby, the net voltage is no longer zero and a correction voltage is developed and applied to the oscillator to pull it back in phase lock with the sync.

We can sum up the foregoing discussion by observing waveforms A, B, C and D in Figure #30. Waveforms A and B are impressed across D-1 when the oscillator is in phase with the sync.

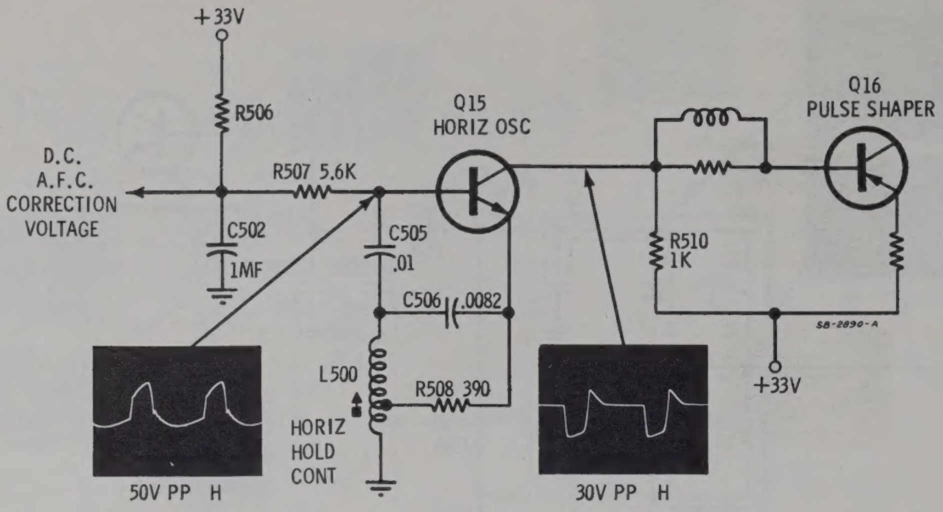


FIGURE 31 - HORIZONTAL OSCILLATOR CIRCUIT

Since the sawtooth (B) is going thru zero at this time, it does not alter the conduction of D-1. Hence, both diodes will conduct equally since their anodes are referenced to zero. No correction voltage is developed under these conditions.

Waveforms A and C are impressed across D-1 when the oscillator is leading in phase with respect to the sync. Now, when the sync pulse turns D-1 on, it will conduct harder than D-2 since waveform C caused its anode to be positive at this time. As a result, the voltage drop across R-501 will be larger than the voltage across R-502 and a negative correction voltage is developed at T.P. "E". This voltage has the proper polarity to slow the oscillator down which pulls it back in phase lock with the sync.

Waveforms A and D are impressed across D-1 when the oscillator is lagging in phase with respect to the sync. Now, when the sync pulse turns D-1 on, it will conduct less than D-2 since waveform D caused its anode to be negative at this time. As a result, the voltage drop across R-501 is less than the voltage drop across R-502, and a positive voltage is developed at T.P. "E". This voltage has the proper polarity to speed up the oscillator which pulls it back in phase lock with the sync.

The AFC network can readily be checked by the following method.

1. Monitor the voltage across the load resistors R-501 and R-502 (T.P. "E") with a VTVM.

2. Rotate the hold control to its two opposite extreme settings and stop prior to the oscillator falling out of lock. The voltage at T.P. "E" should vary between +4.5 volts and -4.5 volts at these two settings of the hold control. If the foregoing checks prevail, the AFC network is receiving the proper waveforms and functioning normally. However, if you do not obtain the proper voltages in the foregoing test, use a scope to check amplitude and shape of the waveforms across D-1. If they do not check okay, there are only a few components in the AFC circuit that could be at fault.

In conclusion, you will discover that basically all horizontal AFC networks are similar in operation.

HORIZONTAL OSCILLATOR

The horizontal oscillator acts like a switch turning on and off at a predetermined rate. From its output, we obtain a driving signal which we can shape, amplify and ultimately apply to the horizontal deflection coils.

The horizontal oscillator, Q-15, receives its initial emitter/base forward bias for starting from R-506 and R-507 (see Figure #31). The base of Q-15 receives a DC voltage from the AFC to keep the oscillator locked in phase and frequency with the station sync.

The horizontal oscillator is similar to the Hartley with a tapped oscillator coil, L-500, in its emitter circuit to sustain oscillation. The main frequency determining components are L-500, C-506, C-505, R-507 and Q-15. In the output of the oscillator, we produce a waveform which resembles a square wave. This waveform is produced by the abrupt switch on, to saturation, and off, to cut off, of the horizontal oscillator transistor. This unsymmetrical square wave is not quite suitable for switching (or driving) the horizontal output transistor.

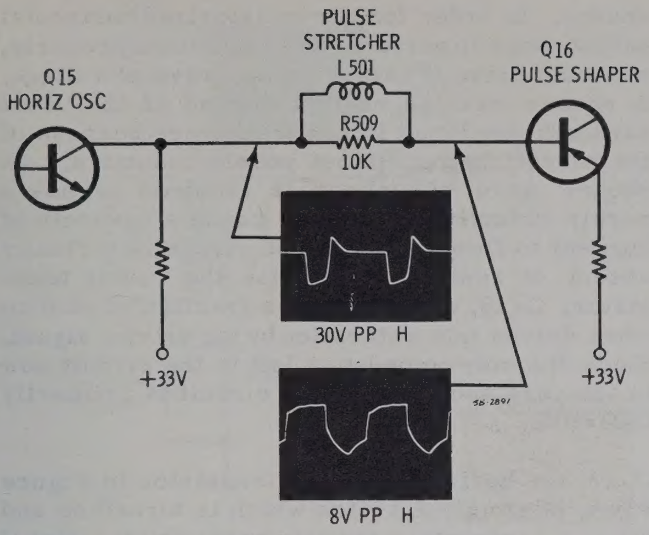

PULSE STRETCHER
L501
R509
10K
Q15
HORIZ OSC
Q16
PULSE SHAPER
30V PP H
+33V
+33V
5B-2891
8V PP H

FIGURE 32 - HORIZONTAL PULSE STRETCHER

L-501 and R-509 are employed (see Figure #32) to shape a more uniform square wave to be applied to the pulse shaper for further shaping and amplification. These two components are called a pulse stretcher. This name is very descriptive because this is exactly what they do. The inductor, L-501, opposes a change in current similar to a choke in a power supply, thus, the spikes and abrupt voltage changes on the existing square wave are filtered out by the inductor.

HORIZONTAL PULSE SHAPER

Another stage is incorporated in the TS-458 to further insure a more perfect square wave (see Figure #33). The pulse shaper, Q-16, achieves this by simply being driven into saturation and cut off by the existing driving signal on its base. This squares the waveform by clipping off the top and bottom portion.

The base of Q-16 is directly coupled to the collector of the oscillator. Therefore, the collector voltage of the oscillator will apply bias to Q-16. Since the emitter of Q-16 and the collector of the oscillator both return to the +33 volt supply, Q-16 will stay in cut-off until the oscillator transistor turns on and forward biases it.

R-512, the emitter stabilizer resistor of Q-16, is employed to prevent thermal runaway. R-511 is to aid the pulse shaper in developing a square wave. R-513 is a collector load resistor for Q-16 and base load for Q-17.

HORIZONTAL DRIVER

The driving signal from the pulse shaper (Q-16) does not have sufficient power to properly drive the horizontal output transistor, therefore necessitating another stage.

Basically, the function of the driver is to amplify the existing driving signal from the pulse shaper to a power level that is sufficient for driving the horizontal output and sweep circuits.

Forward bias is applied to the base of the driver, Q-17, by DC coupling from the collector of the oscillator, Q-15 (see Figure #33). The driver will follow the oscillator as it has no forward bias when the oscillator is cut off. When the oscillator conducts, its collector voltage will turn on the shaper and the driver.

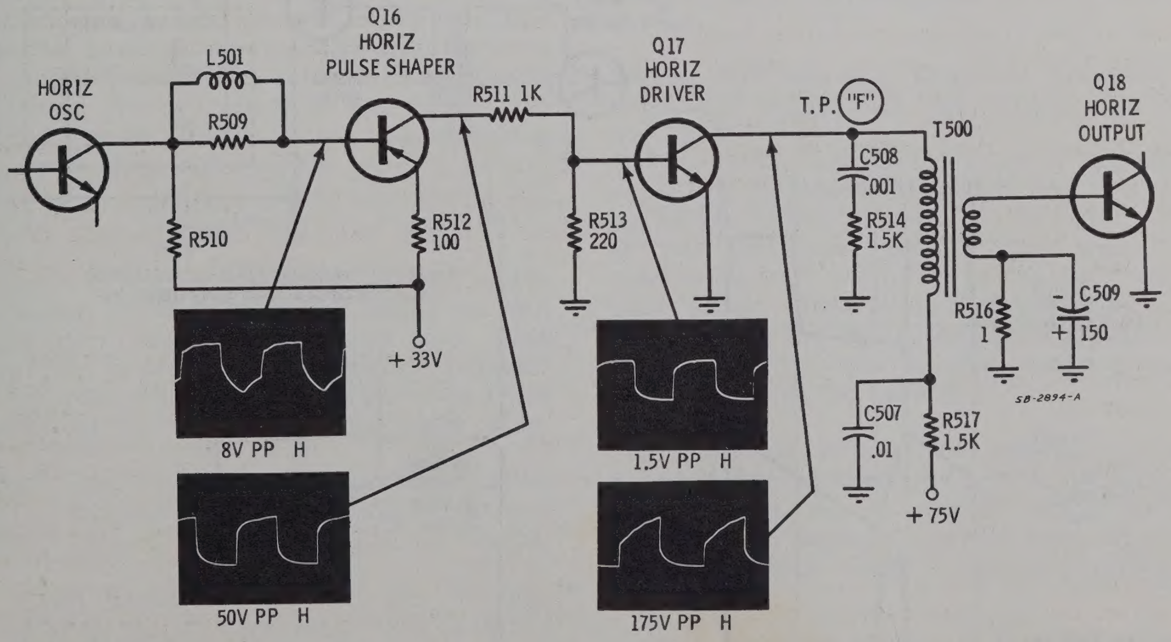

Q16
HORIZ
PULSE SHAPER
L501
HORIZ
OSC
R509
R511 1K
Q17
HORIZ
DRIVER
T.P. "F"
T500
Q18
HORIZ
OUTPUT
C508
.001
R514
1.5K
R510
R512
100
R513
220
R516
1
C509
150
+ 33V
5B-2894-A
C507
.01
R517
1.5K
+ 75V
8V PP H
50V PP H
1.5V PP H
175V PP H

FIGURE 33 - HORIZONTAL PULSE SHAPER AND DRIVER CIRCUIT

The output of the driver is coupled into a driver transformer (T-500). The primary of T-500 is tuned by two capacitors, C-508 and C-507, in order to make it more efficient in coupling power over to its secondary. However, when the driver is driven sharply into cut off, T-500 and its associated capacitors begin to oscillate or ring because the driver stage unloaded the circuit and allowed the "Q" of it to rise. This ringing could exceed the collector/emitter breakdown voltage of the horizontal driver. To prevent this undesirable condition, a damping resistor (R-514) is placed across the tuned primary of T-500 to lower the circuit "Q". This keeps the tuned circuit loaded even when the driver cuts off, hence preventing oscillations from occurring on the driving signal. C-507 also works in conjunction with R-517 to decouple the driving signal from the 75 volt supply.

The driver transformer (T-500) has a turns ratio of approximately 30:1 with the voltage stepped down and current stepped up. This transformer not only provides current step up and coupling to the base of the horizontal output, but also isolation. The two main reasons for providing this isolation is to prevent the DC voltage on the collector of the driver from appearing on the base of the output. The second reason is that, in the event a high voltage arc occurs in the sweep system, the collector of the driver will be isolated from it.

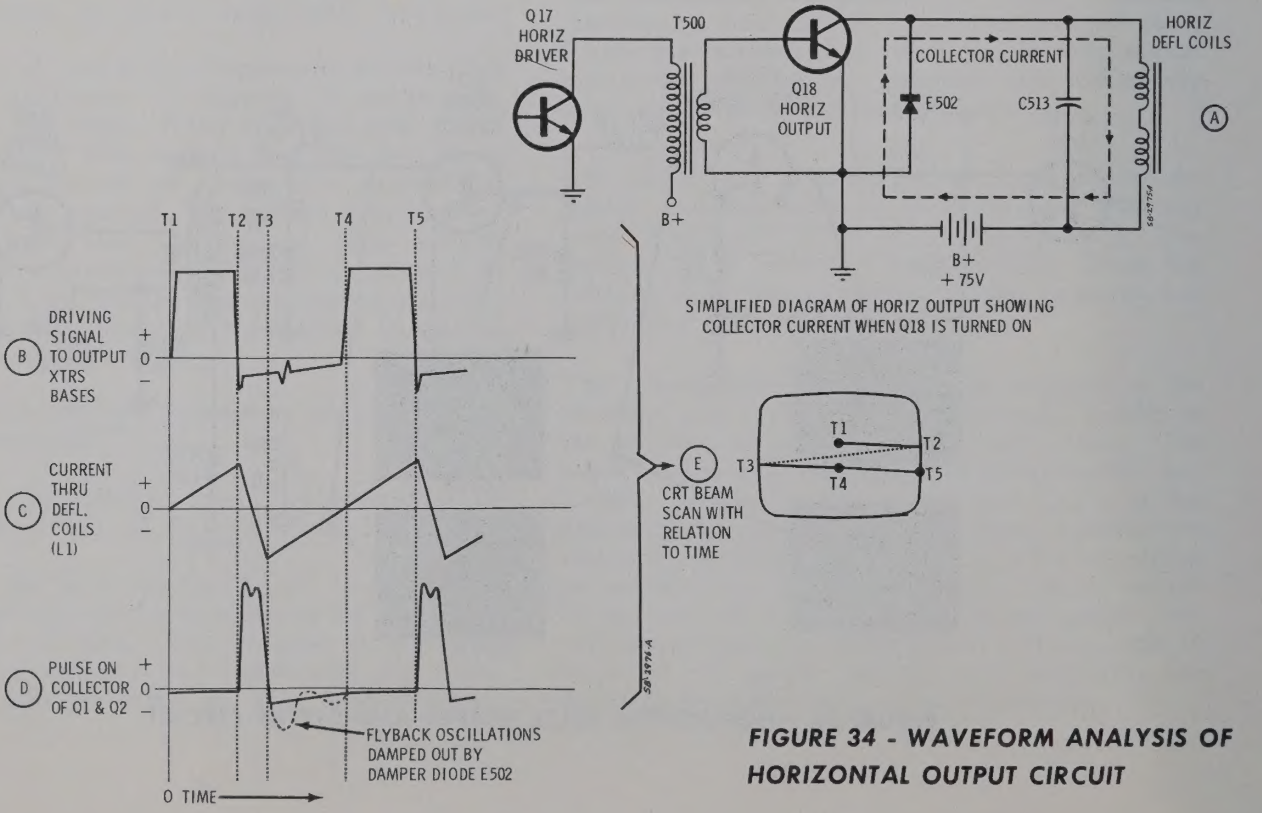
HORIZONTAL OUTPUT

A simplified drawing of the horizontal output stage is shown in Figure #34A. This stage must be capable of developing a sawtooth of current thru the horizontal deflection coils and a high voltage pulse for the high voltage rectifier (not shown). In order for a transistorized horizontal output stage to perform these functions properly, we must drive it with a square wave of voltage. A square wave is needed instead of the usual sawtooth employed in tube receivers because of the circuit being almost purely inductive. (A square wave of voltage is required across a purely inductive circuit to cause a sawtooth of current to flow thru it.) The circuit is virtually absent of resistance because the output transistor, Q-18, exhibits only a fraction of an ohm when driven into saturation by the driving signal. Since the only impedance left in the circuit now is the yoke and flyback, the circuit is primarily inductive.

Q-18, the horizontal output transistor in Figure #34A, is simply a switch which is turned on and off at a horizontal scan rate by the driving signal applied to its base. Figure #34B illustrates the following with respect to time, (B) driving signal applied to base of Q-18, (C) current thru deflection coils, (D) pulse appearing on collector of Q-18 during retrace and (E) CRT scan relative to time.

Figure #34B shows the drive voltage applied to the base of Q-18. From time 1 to time 2, the input signal turns on Q-18 and drives it into saturation. In this condition, the emitter/collector resistance is reduced to a fraction of an ohm, thus similating a closed switch. Figure #34C, during this time, illustrates the flow of current from zero to maximum through the yoke (horizontal deflection coils) in a direction to move the beam from the center of the screen to the right side.

At time 2, Q-18 is driven sharply into cut-off, thus initiating horizontal retrace.



SIMPLIFIED DIAGRAM OF HORIZ OUTPUT SHOWING COLLECTOR CURRENT WHEN Q18 IS TURNED ON

FIGURE 34 - WAVEFORM ANALYSIS OF HORIZONTAL OUTPUT CIRCUIT

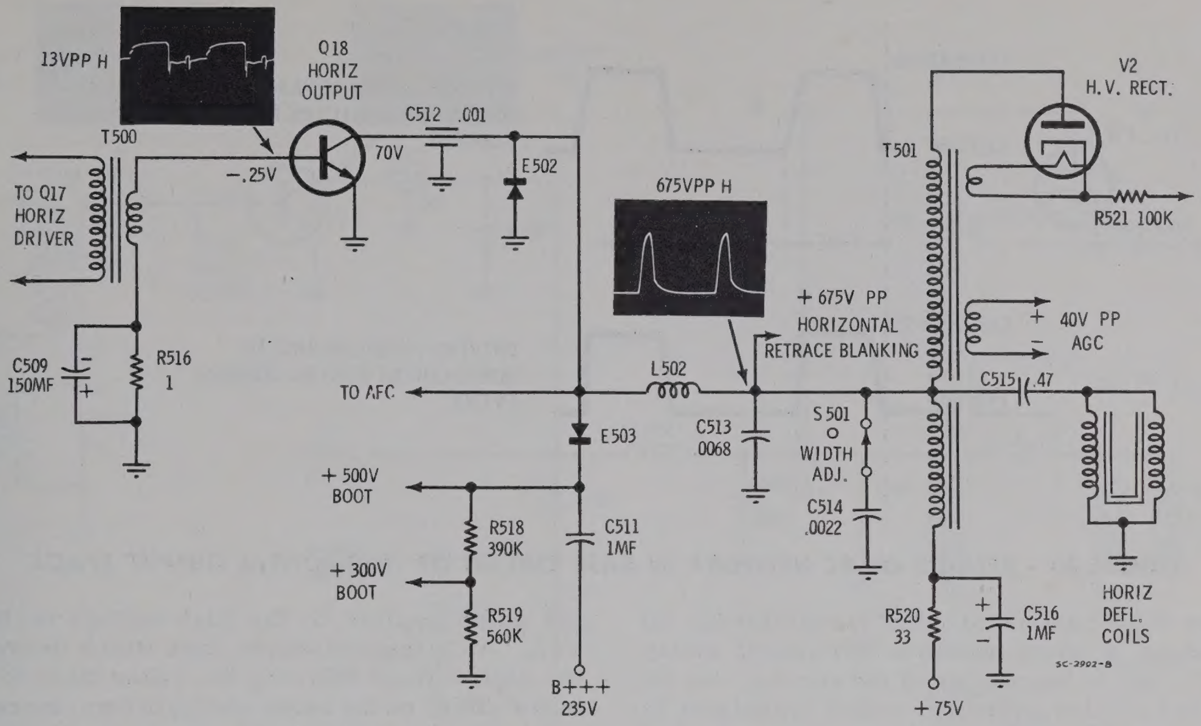


FIGURE 35 - COMPLETE HORIZONTAL OUTPUT AND HV CIRCUIT

Between time 2 and time 4, Q-18 is driven into cut-off, and the current supplied to the deflection coils ceases. However, an induced voltage appears across the deflection coils as the magnetic field collapses and an oscillation then occurs between the deflection coils and C-513. The damper diode, E-502, then conducts on the negative rings of this oscillation and the beam is returned to the center of the screen at a linear rate.

From time 2 to time 3, the direction of current through the yoke is shown in Figure #34C. During horizontal retrace, the current rises to a high value in the reverse direction causing retrace which quickly returns the beam to the left side of the screen. Then, from time 3 to time 4, the yoke current gradually decreases to zero during damper conduction allowing the beam to return to the center of the screen. The beam movement relative to time is illustrated in Figure #34E.

From time 4 to time 5, Q-18 is turned on by the driving signal on its base, thus causing current to rise (Figure #34C) at a sawtooth rate. This rising current produces an increasing magnetic field in the yoke which will deflect the beam from the center of the screen to the right side.

When the beam reaches the right side of the screen, Q-18 is abruptly cut off causing retrace and again, repeating the sequence of events.

Figure #34D indicates the collector voltage waveform of Q-18. The instant Q-18 is switched off, the collapsing magnetic field produces a positive pulse. This pulse is stepped up by the flyback transformer (not shown) and rectified to produce the required high voltage to accelerate the CRT beam toward the screen.

Transistors, unlike tubes, require bias to turn on and, if you will note, the horizontal output stage has no DC voltage paths to its base to form the required emitter/base forward bias for turning on (see Figure #35). Q-18 will turn on when the driving signal on its base is positive enough to forward bias it, therefore, no harm will be done to the horizontal amplifier stage in the event we lose drive. This is a good thought to keep in mind when servicing the horizontal sweep system.

Figure #35 shows a complete diagram of the horizontal output and high voltage rectifier in the TS-458.
C-512, L-502 and C-513 form a "pi-filter" to suppress transients (oscillations) that are set up in the sweep system due to rapid switching of the horizontal output transistor. These transients will occur up in the VHF and even UHF bands. This being the case, they could be picked up by the tuner, amplified and will appear as "spooks" (vertical shaded bars in picture) on the left side of the screen.

Since the low side of the deflection coils are connected to chassis, a capacitor (C-515) must be inserted in series with the yoke. This capacitor prevents high DC current from flowing thru the coils which would cause decentering of the raster.

A damper diode (E-502) is effectively connected across the deflection coils. This diode works in association with the collector/base diode

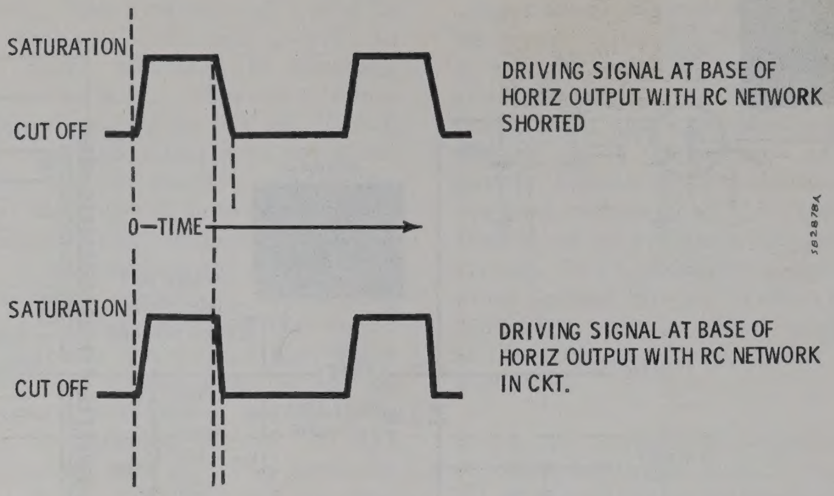

SATURATION
CUT OFF
DRIVING SIGNAL AT BASE OF HORIZ OUTPUT WITH RC NETWORK SHORTED
0—TIME
SATURATION
CUT OFF
DRIVING SIGNAL AT BASE OF HORIZ OUTPUT WITH RC NETWORK IN CKT.
5B2878A

FIGURE 36 - EFFECTS OF RC NETWORK IN BASE CIRCUIT OF HORIZONTAL OUTPUT STAGE

junction of the horizontal output transistor (Q-18) to produce a more uniform horizontal sweep from the left to the center of the screen. As we discussed earlier, when the output transistor is abruptly cut off, an oscillation occurs across the deflection coils. The current thru the coils rises to a large value in the opposite direction causing retrace. After retrace, E-502 and collector/base diode junction of Q-18 will be forward biased by the negative going rings of this oscillation thus damping out the rings and decreasing the current. This allows the beam to return to the center of the screen at a linear rate.

A second diode, E-503, is employed in the high voltage as a boost rectifier. Its task is to develop a +500V DC boot voltage by rectifying the existing positive pulse occurring on its anode during horizontal retrace. A filter capacitor, C-511, will filter this rectified pulse and an average +500 volt boot voltage will be developed.

A secondary function of the boot rectifier (E-503) is to prevent any high voltage from appearing on the collector of Q-18 in the event a high voltage arc occurs in the system. A typical example of this would be a P.I.V. breakdown of V-2. The instant this voltage reaches +500 volts, E-503 will turn on allowing C-511 to absorb the arc. Since this +500 volt is well under the 800 volt collector/emitter breakdown of the horizontal output transistor (Q-18), no harm will be done to it.

S-501 is a width adjustment (consisting of a jumper type arrangement on the rear sub-chassis) which enables us to vary the width of the raster. This is accomplished by connecting C-514 in or out of the circuit.

When C-514 is in the circuit, we have an increase in width and a decrease when out of the circuit. C-514 has a loading effect when connected in the circuit resulting in a reduction in amplitude of the pulse applied to the high voltage rectifier, V-2. V-2 than conducts less which decreases the high voltage allowing the yokes field to have more effect on the beam which, in turn, increases width. R-520 and C-516 decouples the horizontal sweep current from the power supply.

Positive 675V PP pulses are derived from the flyback circuit and will be utilized for horizontal retrace blanking (turning off the CRT during the horizontal retrace interval) and AFC correction. An AGC winding which is isolated from the chassis is employed to key our AGC stage.

V-2 serves as the high voltage rectifier. R-521 works in conjunction with the CRT capacity to insure adequate filtering of the high voltage applied to the picture tube.

The transition of time between saturation and cut off of Q-18 in Figure #35 is very critical. If this time is too long, the maximum collector dissipation of Q-18 would be exceeded. This, of course, would eventually destroy the transistor. To alleviate this undesirable condition, we incorporate an "RC" network (R-516 and C-509) in the base circuit of Q-18.

When Q-18 is driven into saturation by the driving signal, C-509 will charge up negative very rapidly thru its emitter base junction. When Q-18 is driven toward cut-off, C-509 will then discharge thru R-516 to chassis developing a negative voltage at the base. The negative voltage will supplement the negative going driving signal insuring a more rapid cut off of Q-18. The transition of time between saturation and cut off has now been decreased which, in turn, decreases the collector dissipation. By keeping the collector dissipation at a minimum, Q-18 becomes more reliable.

Figure #36 is an illustration of the slower cut off time of the horizontal output stage in the event C-509 shorted.

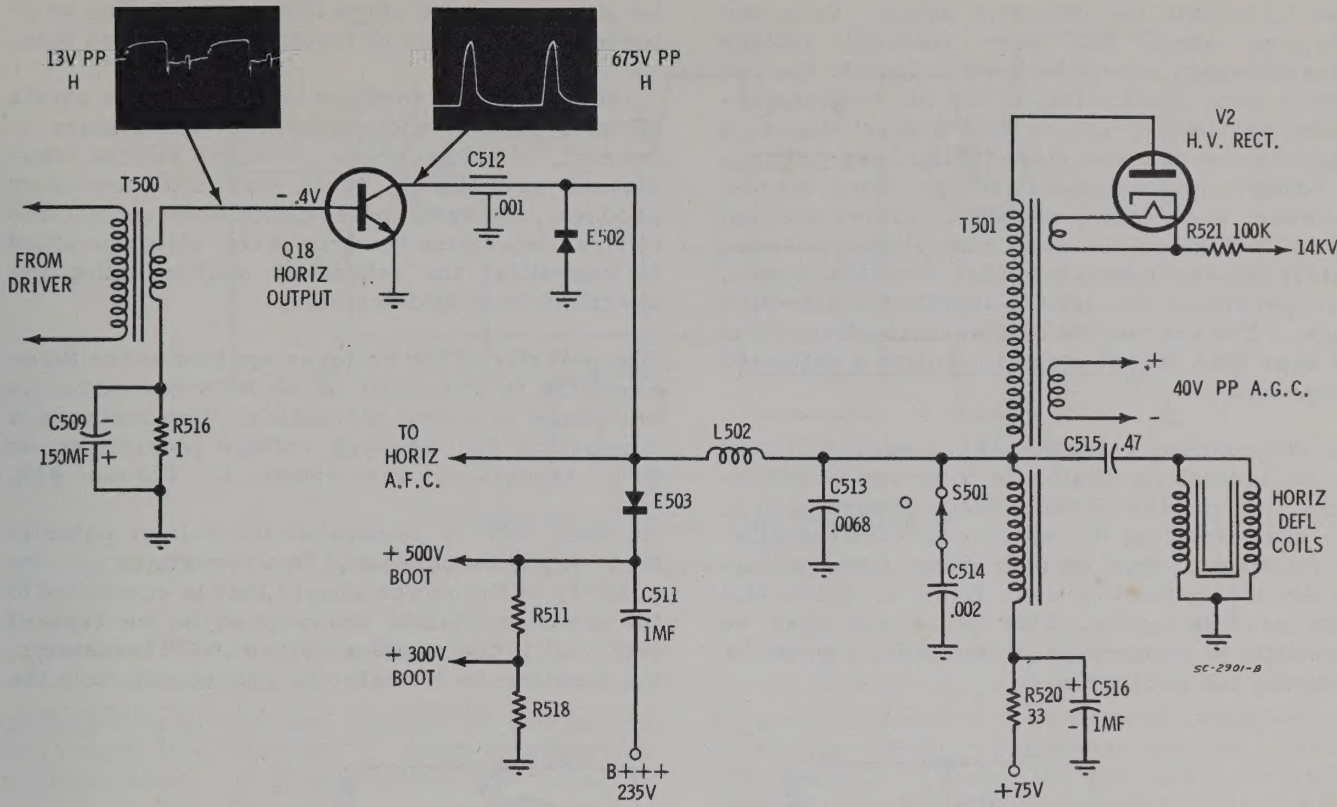

13V PP
H
675V PP
H
T500
FROM DRIVER
-.4V
Q18
HORIZ
OUTPUT
C512
.001
E502
V2
H.V. RECT.
T501
R521 100K
14KV
40V PP A.G.C.
+
-
C509
150MF
R516
1
TO
HORIZ
A.F.C.
L502
C513
.0068
S501
C515
.47
HORIZ
DEFL
COILS
E503
+ 500V
BOOT
R511
C511
1MF
C514
.002
+ 300V
BOOT
R518
B+++
235V
R520
33
C516
1MF
+75V
SC-2901-B

FIGURE 37 - TROUBLESHOOTING HORIZONTAL OUTPUT AND HV

TROUBLESHOOTING HORIZONTAL SWEEP SECTION

Loss of horizontal drive to the output transistor, Q-18, will not damage the output stage. This transistor is not forward biased, therefore, without driving signal from the driver transformer, T-500, this transistor will remain off, preventing damage to the output section (see Figure #37).

A shorted output transistor will normally cause the circuit breaker in the power supply to open.

When analyzing a receiver with faulty horizontal sweep circuits, the defective stage should first be isolated. A scope should be used to check horizontal driving voltage at T.P. "F", the collector of driver stage, Q-17 (see Figure #38). Presence of this driving voltage (approximately 160V PP) would indicate that oscillator shaper and driver are operating, and the the output section is defective. Absence of this driving voltage would indicate a defect in oscillator, shaper or driver stage. A scope can be further

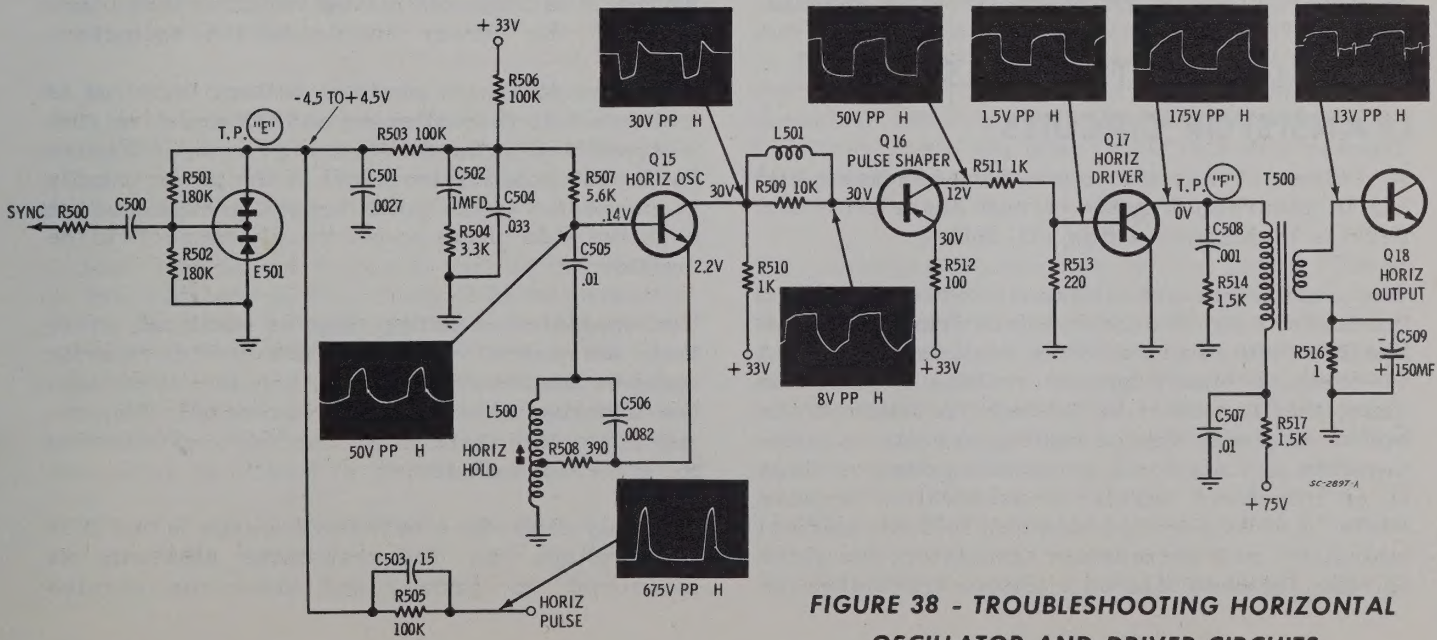

+ 33V
R506
100K
-4.5 TO +4.5V
T.P. "E"
R503 100K
SYNC
R500
C500
R501
180K
R502
180K
E501
C501
.0027
C502
1MFD
C504
.033
R504
3.3K
R507
5.6K
Q15
HORIZ OSC
.14V
C505
.01
30V PP H
L501
R509 10K
30V
2.2V
R510
1K
+ 33V
50V PP H
Q16
PULSE SHAPER
30V
12V
30V
R511 1K
R512
100
+33V
8V PP H
1.5V PP H
Q17
HORIZ
DRIVER
R513
220
175V PP H
T.P. "F"
0V
T500
C508
.001
R514
1.5K
13V PP H
Q18
HORIZ
OUTPUT
C509
150MF
R516
1
C507
.01
R517
1.5K
+ 75V
50V PP H
L500
C506
.0082
HORIZ
HOLD
R508 390
675V PP H
C503
15
R505
100K
HORIZ
PULSE
SC-2897-A

FIGURE 38 - TROUBLESHOOTING HORIZONTAL OSCILLATOR AND DRIVER CIRCUITS

used to isolate the defective stage. Once the defective stage has been isolated, voltage measurements should be used to isolate the defective component. Due to the DC coupling between oscillator, shaper and driver stages, a defect in one of these stages will cause a change in voltage measurement on the other stages. However, a defective shaper or driver will not normally disable the oscillator although it may distort the waveform somewhat. For this reason, a scope should be used to isolate the defective stage. Then it may be necessary to disconnect the base lead of that stage to isolate a defective component.

The range during which the AFC circuit will hold the horizontal oscillator in sync can be determined by measuring the voltage change at T.P. "E" while rotating the hold control until oscillator falls out of sync on both sides. The oscillator should remain in sync from a -4.5 to +4.5 volts at this point. This point can also be grounded to determine if the AFC circuit is disabling the oscillator.

TROUBLESHOOTING PROCEDURES

The following section has been devoted to developing troubleshooting techniques for basic transistor circuits. Also, detailed procedures are outlined for troubleshooting various sections of Motorola's new TS-458 solid state chassis.

TROUBLESHOOTING BASIC TRANSISTOR CIRCUITS

A review of transistor operation and biasing will aid in understanding the circuit description and service techniques which will follow.

The most important difference between a silicon transistor and the germanium transistor that has been so common in the past, is the amount of forward bias (turn on) voltage required to cause the transistor to conduct. A silicon transistor requires approximately .6 volts as compared to .2 volts for a germanium device. This is an important service consideration because while .2 volts forward bias can indicate normal operation on a germanium transistor, the same .2 volts forward bias on a silicon transistor can be indicative of a stage that is oscillating or is turned off because of insufficient forward bias.

Since this basic forward bias difference exists between silicon and germanium transistors in general, and since more and more silicon transistors are finding their way into consumer products, it now becomes a good service practice to first determine the type of transistor involved by consulting the schematic and/or noting the specified base emitter bias.

The polarity of the voltages applied to the three elements is reversed on an NPN transistor as compared to a PNP transistor. Two methods of connecting the correct voltage polarity to an NPN transistor are shown in Figure #39.

An easy way to remember the voltage polarity that should be connected to a transistor is: the polarity of the power supply that is connected to the emitter should correspond to the type of material in the emitter. With an NPN transistor, the emitter is N material and should have the negative side of the supply connected to it. On a PNP transistor, the emitter if P material and the positive side of the supply should be connected to the emitter.

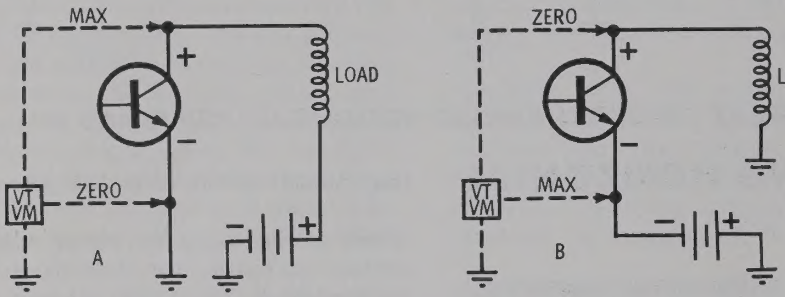


FIGURE 39 - BATTERY CONNECTS TO NPN TRANSISTORS

Once correct polarity for the emitter is established, it is a simple matter to connect the other side of the power supply to the collector.

In Figure #39A, the positive battery terminal is connected to the collector and the negative side is connected to the emitter via ground. In Figure #39B, the positive terminal of the power supply is connected to the collector via ground and the negative side of the power supply connects to the emitter.

The operation of either stage is identical. Note that the same voltage of the same polarity appears across each transistor. In either case, the negative side of the power supply is connected to the emitter as has been established for a NPN transistor.

The only difference between Figures A and B is the voltage on the transistor elements as measured to ground and since the service

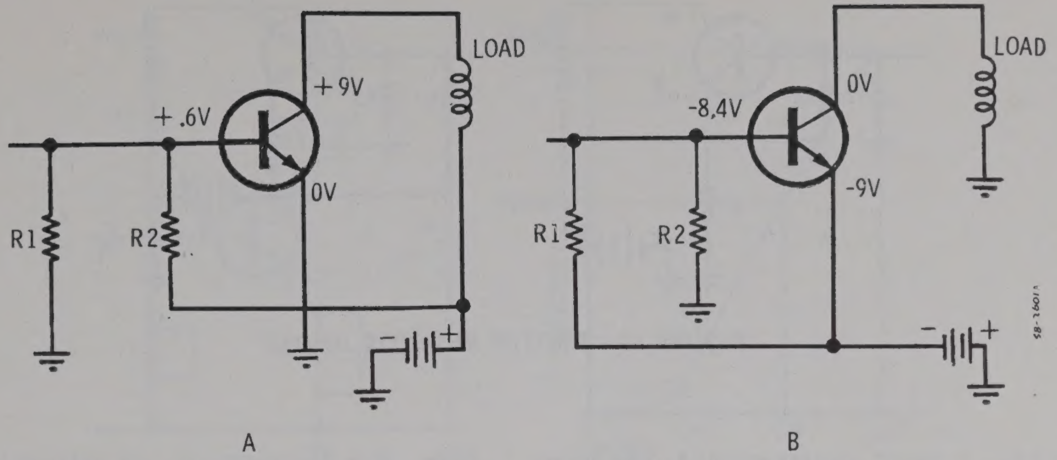


FIGURE 40 - TYPICAL BIAS NETWORK

technique is to measure voltages as referenced to ground, this becomes an important service consideration. In Figure #39A, the collector voltage is near maximum or supply voltage and the emitter voltage is zero while in Figure #39B the collector voltage is near zero and the emitter voltage is near maximum (negative) or supply voltage. The important consideration is the voltage across the transistor elements and, in both cases, the collector is equally positive with respect to the emitter.

Another consideration is the polarity and magnitude of voltage that must be applied to the base/ emitter elements in order to turn the transistor on and cause electrons to flow from emitter to collector. While a tube requires bias to reduce electron flow, the transistor requires bias to cause electrons to flow. A tube with zero bias between grid and cathode will generally have heavy current flow while a transistor with zero bias between base and emitter is turned off and no current will flow.

To forward bias or turn on a transistor, a small voltage is applied between the base and emitter elements. When measured from the emitter, the polarity of this bias voltage will be the same as the collector voltage.

A good rule to remember is that as the voltage on the base element is changed in the direction of the collector potential, the emitter/collector current will increase. If the voltage on the base element is changed in the direction of the emitter potential, the emitter/collector current will decrease. This is true regardless of whether the transistor is silicon or germanium and NPN or PNP.

Figure #40 shows a typical bias arrangement. In Figure #40A, the negative terminal of the power supply is grounded (as in Figure #39A) and in Figure #40B, the positive terminal of the power supply is grounded (as in Figure #39B). The operation of either circuit is identical. R-2 and R-1 form a voltage divider network and selection of various values of R-2 and R-1 can result in any voltage between the supply voltage and zero volts to be developed on the base of the transistor. If values are chosen to cause a .6 volt difference to exist between base and emitter, the transistor will be turned on and emitter/collector current will flow. If this voltage difference is reduced, less collector/emitter current will flow and conversely, if this voltage difference is increased, more collector/emitter current will flow.

In Figure #40A, if a 9 volt supply is used, R-2 would be approximately 8.5 times as large as R-1 and +.6 volt would be developed on the base. In Figure #40B, the values of R-1 and R-2 stay the same except their relative positions are reversed to affect a -8.4 volt potential on the base. In either case, the base is +.6 volt with respect to the emitter.

The voltages shown are typical for a silicon transistor. Note that the base voltage is close to the emitter voltage and between the collector/ emitter voltage. The collector/emitter voltage can vary considerably in various applications, but the base voltage will be close to the emitter voltage and generally .6 volt away from the emitter voltage toward the collector voltage.

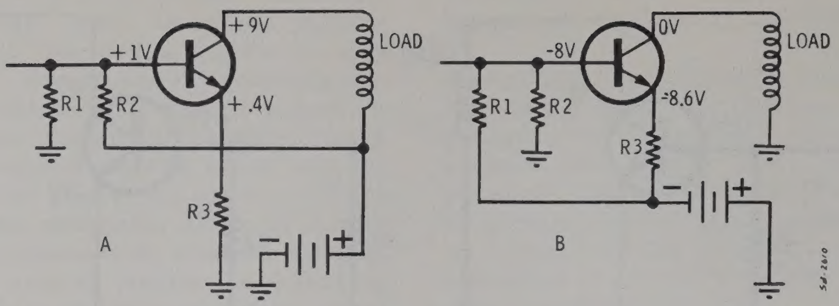


FIGURE 41 - EMITTER RESISTOR ADDED

In Figure #41, a third resistor, R-3, has been added in series with the emitter. This resistor is used to stabilize the collector current and is often referred to as a current limiter or stabilizing resistor. As collector current flows through the emitter resistor (R-3), a voltage is developed which opposes the forward bias voltage. The effect of R-3 is to oppose any change in current flow since the voltage across it is in series with the forward bias voltage. For example, if collector current increases, the voltage drop across R-3 increases and reduces the effective forward bias which, in turn, reduces collector current. Conversely, if collector current decreases, there is less voltage developed across R-3 and the effective forward bias increases which, in turn, increases collector current. Hence, adding an emitter resistor will stabilize a transistor with respect to collector current variations which may occur for a variety of reasons, the most common being an increase in collector current as a function of an increase in temperature.

From a servicing standpoint, the voltage drop across the emitter resistor is a very important clue for determining circuit operation. A higher than normal emitter resistor voltage would generally indicate excessive collector current which could be due to a shorted transistor or a bias defect. A lower than normal emitter resistor voltage would generally indicate an open transistor or bias defect.

Figure #42 shows a typical transistor stage adjusted for Class A or linear operation.

In this stage, one of the bias resistors (R-1) is shown as an adjustable one that might be used to establish a bias voltage so that some desired collector current will flow. This control can also be used to show how the transistor amplifies the input signal.

The base voltage - collector current curve in Figure #42 shows the collector current for several different base voltages. The horizontal line shows several bias voltage developed across bias resistor, R-1. The vertical line shows values of collector current for each value of bias. For the moment, we will neglect the effect of the emitter resistor, R-3.

Note first the mark on the bottom line indicating 1.64 volts. This actually means .64 volts between the base and emitter since the emitter is at +1 volt. This mark corresponds with a line on the vertical column marked "minimum" as indicated with dotted lines. This means that with .64 volt forward bias, only a small amount of collector current will flow.

If R-1 is re-adjusted to cause the base to become +1.69 volts (.69 volt between base and emitter), the collector current will increase. Referring again to the curve, we see that the collector current has increased to the mark on the vertical column marked "medium".

If R-1 is re-adjusted to cause the base to become +1.74 volts (.74 volt between base and emitter), there will be a further increase in collector current. The curve now shows the current through the transistor to be maximum.

From this we can see that by adjusting the base voltage, we can cause any desired value of collector current. In actual practice, the emitter voltage would not remain a constant 1 volt with different values of collector current. As mentioned earlier, this voltage will always try to counteract any DC current change through the transistor. For explanation purposes, this voltage change was neglected. Its only effect would be that we would have to make a greater change in the voltage across R-1 in order to realize the changes in collector current indicated. How much more will depend on the transistor and the value of the emitter resistor.

Consider now how alternating signals fed to the base element can also cause collector current changes. Referring again to Figure #42, we re-adjust R-1 to cause the base to be +1.69 volts. This causes a collector current that corresponds to "medium" on the curve. Note that the current meter in the collector circuit is reading center scale. The collector current through R-4 causes a voltage drop so that approximately one-half of

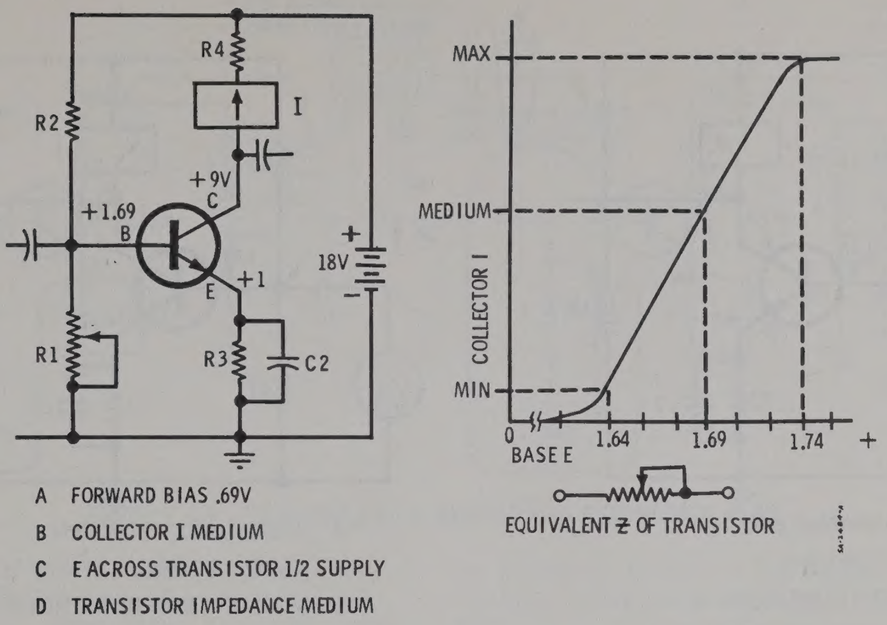


FIGURE 42 - TYPICAL CLASS A SILICON TRANSISTOR STAGE

the supply voltage appears at the collector. These are the necessary conditions for a linear stage (can amplify without excessive distortion). Since both the collector voltage and collector current are medium values, they can be caused to increase and decrease the same amount with changes in base voltage.

Figure #43 shows two circuits similar to Figure #42. R-1 was adjustable in the prior drawing for explanation purposes only. Once a correct value is chosen, it can be and usually is a fixed resistor.

In Figure #43, an AC generator has been connected to supply a signal between the base of the transistor and chassis ground. This signal at any instant, will add or subtract from the DC voltage that is supplied by the bias resistors R-1 and R-2. Capacitor C-2 provides an AC short across R-3 at the signal frequency.

In Figure #43 (first example), the generator is passing through its maximum positive excursion and is producing a peak +.05 volt. This voltage will add to the +1.69 volts DC voltage and cause a total instantaneous voltage between base and ground of +1.74 volts. From the curve in Figure #42, we see that this corresponds to maximum current through the transistor. This is indicated by the current meter connected in series with the collector of the transistor.

The increased current through R-4 causes a larger voltage drop so that, for an instant, the collector voltage drops to approximately 2.5 volts.

Figure #43 (second example) shows the result of a negative half cycle of the generator. This negative .05 volt excursion subtracts from the 1.69 volts so that, for an instant, the voltage between base and ground is 1.64 volts. The curve in Figure #42 shows that this corresponds to minimum collector current. The reduced current causes a smaller voltage drop across R-4 and allows the collector voltage to rise to approximately +15.5 volts.

From this we can see that an input signal of .1 volt PP can cause a collector or output signal of 13 volts PP. The DC voltage and AC voltage excursions shown in this example are somewhat representative of all silicon transistor circuits and serve to demonstrate the principles involved. Capacitor C-2 is usually large enough to by-pass R-3 so that the AC signal is not lost across this resistor. The voltage at the emitter will, however, disclose any average current change through the transistor, making this voltage a very important consideration when servicing a transistor stage. If the voltage is too high (compared to value in service manual), the transistor current is too large. If it is too low, the current is too low.

The circuits discussed so far are linear ones for minimum distortion to the input signal. These are the most common but by no means the only application for transistors. In some cases, the transistor may be used as an electronic switch. In this case, the stage may not have a DC forward bias circuit but uses a driving signal on the base to turn it on (heavy collector current) at the desired time and off when no signal is present. These variations will be discussed in the individual circuit descriptions.

Incidentally, here is an easy way to remember what constitutes an "on" signal for a transistor. If the driving signal has the same polarity as the base material, it is an "on" signal. An

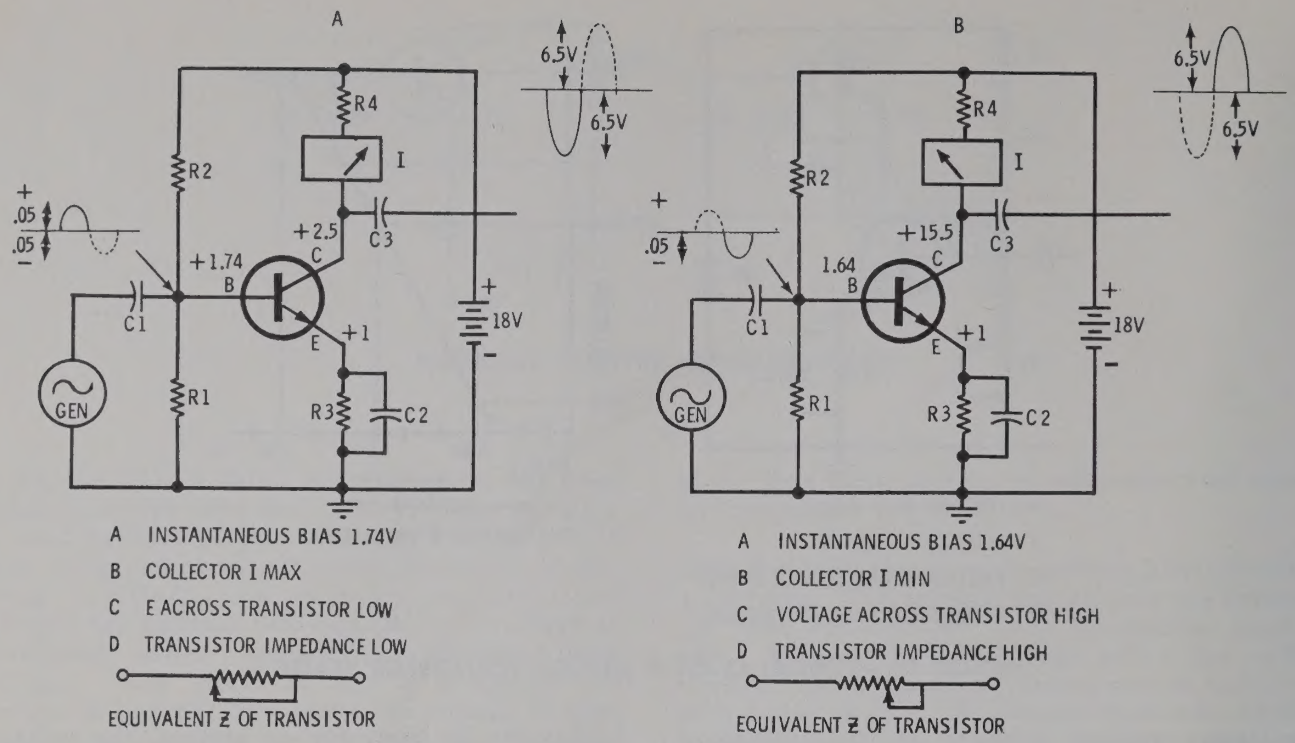

A
6.5V
6.5V
R4
I
R2
+
.05
.05
−
+2.5
C3
+1.74
C
B
+
C1
E
+1
18V
−
GEN
R1
R3
C2
A INSTANTANEOUS BIAS 1.74V
B COLLECTOR I MAX
C E ACROSS TRANSISTOR LOW
D TRANSISTOR IMPEDANCE LOW
EQUIVALENT Z OF TRANSISTOR
B
6.5V
6.5V
R4
I
R2
+
.05
−
+15.5
C3
1.64
C
B
+
C1
E
+1
18V
−
GEN
R1
R3
C2
A INSTANTANEOUS BIAS 1.64V
B COLLECTOR I MIN
C VOLTAGE ACROSS TRANSISTOR HIGH
D TRANSISTOR IMPEDANCE HIGH
EQUIVALENT Z OF TRANSISTOR

FIGURE 43 - SIMPLIFIED TRANSISTOR AMPLIFIER STAGE

example of an "on" signal would be if you fed a positive going signal to an NPN transistor. Driving signals of the opposite polarity will turn the transistor off.

CHECKING A TRANSISTOR STAGE WITH THE TRANSISTOR IN PLACE

In transistor circuits, many defects can be localized by measuring the voltage on the transistor elements, since the defective component, in many cases, will upset the current drawn by the stage. This change from normal current will cause a different voltage to develop across the resistive components in the circuit.

Figure #44 shows a typical transistor circuit with the necessary meter connections for measuring voltage drop as a result of transistor current. Electron flow is normally in the direction indicated by the arrows and causes the polarity of voltage drop across the resistors as shown.

A collector resistor is inserted in series with the output circuit and the voltage drop across this resistor is a function of the transistors collector current.

If a circuit irregularity is indicated by an incorrect collector voltage as compared to the service manual, it then becomes desirable to know is the transistor is capable of controlling collector current. If we can determine that the transistor base is not capable of controlling current, we would suspect that the transistor is defective. If we find that the base is capable of controlling current, we would then suspect that the stage is biased incorrectly indicating a defective bias resistor or other component such as a shorted coupling capacitor.

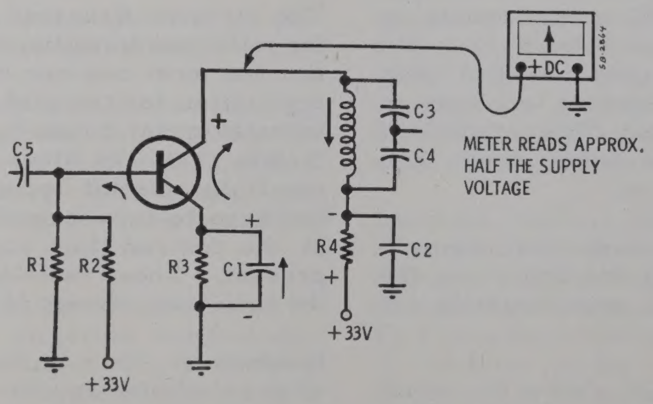

+DC
C3
C4
METER READS APPROX. HALF THE SUPPLY VOLTAGE
C5
+
R1
R2
+33V
R3
C1
+
−
−
R4
+
C2
+33V

FIGURE 44 - CIRCUIT CONNECTIONS FOR MEASURING VOLTAGES

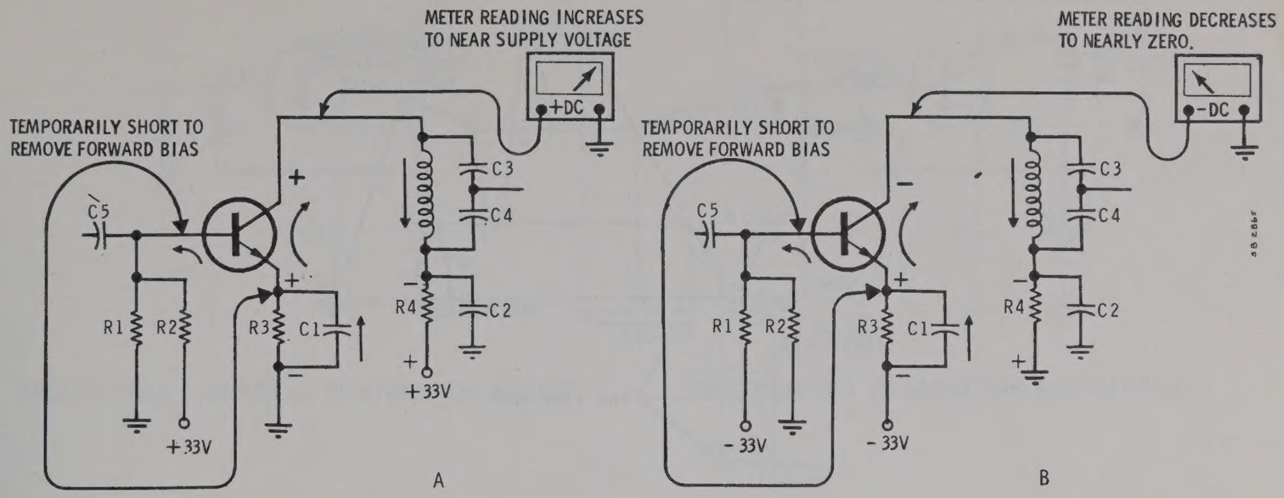

METER READING INCREASES TO NEAR SUPPLY VOLTAGE
+DC
TEMPORARILY SHORT TO REMOVE FORWARD BIAS
C5
C3
C4
R1
R2
R3
C1
R4
C2
+33V
+33V
A
METER READING DECREASES TO NEARLY ZERO.
-DC
TEMPORARILY SHORT TO REMOVE FORWARD BIAS
C5
C3
C4
R1
R2
R3
C1
R4
C2
- 33V
- 33V
B

FIGURE 45 - TEMPORARILY REMOVING FORWARD BIAS

We can determine if the transistor base is capable of controlling collector current by temporarily adding to or subtracting from the bias voltage and noting if there is a change in collector voltages.

Figure #45 shows two examples where the collector current was high which would be measured by using the procedure previously mentioned. Since the collector current was high, we should temporarily remove the forward bias from the stage and determine if this will reduce it. One simple way of removing forward bias would be to simply short the base and emitter elements of the transistor together using a small screwdriver. CAUTION: Do not short base to collector.

If after removing the forward bias, the collector voltage does not measure as indicated in Figures #45A and B, you can make a pretty good guess that the base element is not able to control collector current and probably indicates a defective transistor. However, if the collector voltage is as indicated, this reveals that the base is capable of controlling collector current, the transistor is probably good and the defect is likely to be a biasing component such as R-1, R-2 or a shorted C-5.

If measuring the collector voltage discloses an abnormal reading, that is, a high reading in Figure #46A and a low reading in Figure #46B, it becomes necessary to temporarily increase the forward bias to determine if the base element is capable of causing collector current. This procedure is shown in Figure #46. The base element should be temporarily connected to the collector element through a series resistor R that is similar in value to bias resistor R-2.

If the transistor base element has control of the current, connecting the resistor as shown should cause an increase in collector current and the collector voltage should be as indicated in Figures #46A and B. This reveals that the transistor is probably good and a biasing defect such as R-1, R-2 or shorted C-5 is indicated. If attaching the resistor as indicated does not increase the collector current, the transistor is likely open.

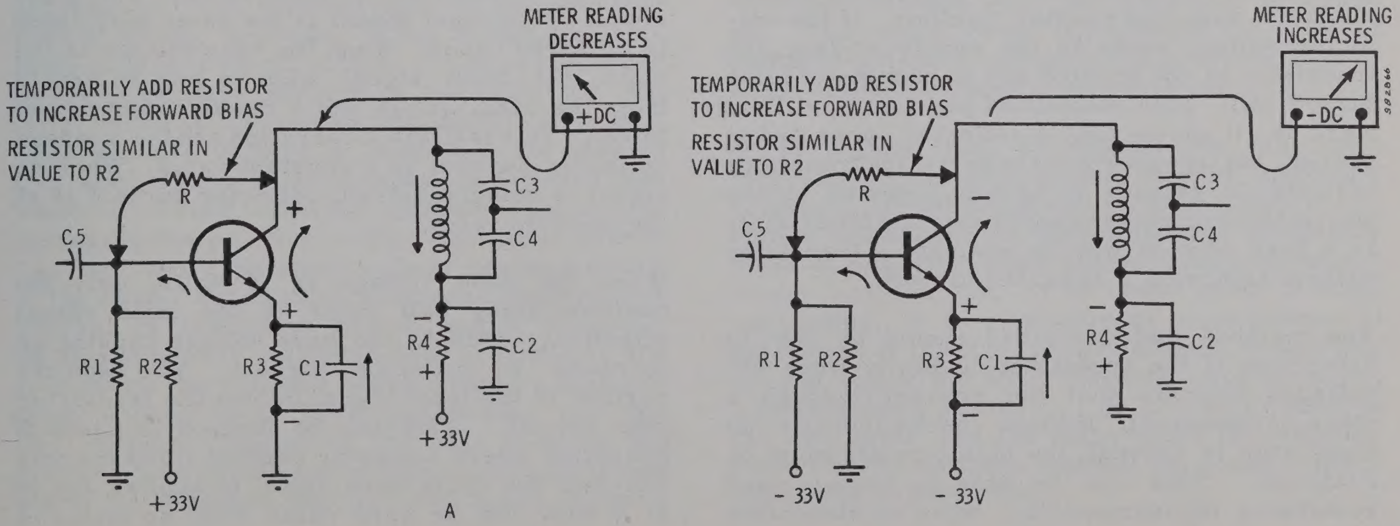

METER READING DECREASES
+DC
TEMPORARILY ADD RESISTOR TO INCREASE FORWARD BIAS
RESISTOR SIMILAR IN VALUE TO R2
R
C5
C3
C4
R1
R2
R3
C1
R4
C2
+33V
+33V
A
METER READING INCREASES
-DC
TEMPORARILY ADD RESISTOR TO INCREASE FORWARD BIAS
RESISTOR SIMILAR IN VALUE TO R2
R
C5
C3
C4
R1
R2
R3
C1
R4
C2
- 33V
- 33V

FIGURE 46 - TEMPORARILY ADDING FORWARD BIAS

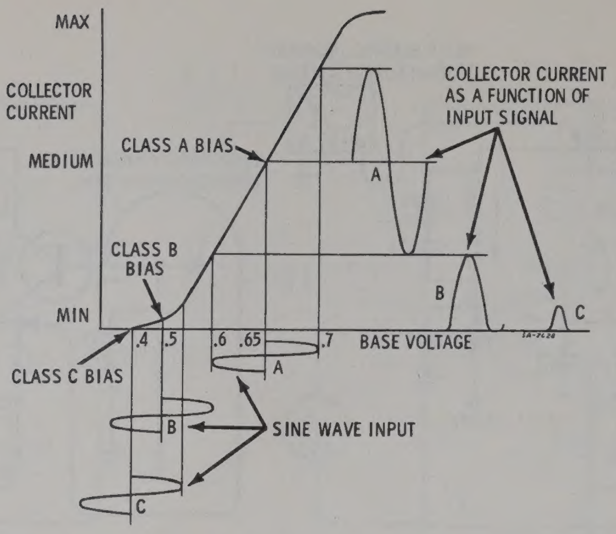


FIGURE 47 - OUTPUT CURRENT AS A FUNCTION OF CLASS A, B AND C OPERATION

One caution should be observed with effecting a removal of forward bias to evaluate transistor action. Since removing forward bias turns off collector current, the collector voltage rises to its supply voltage and there is a possibility of this voltage exceeding the breakdown voltage on the transistor. While this condition will not exist on the TS-458 chassis, it can become important if this technique is applied on other transistorized circuitry. A good rule to apply in these cases is to note the presence and value of collector load and emitter resistors which will govern the amount of current that will flow if the breakdown voltage is exceeded. If these resistors will limit the current to a value within the power dissipation of the transistor, there is little likelihood of damage if the breakdown voltage is slightly exceeded by a brief interval.

As experience is gained in this "in circuit transistor testing", the procedure, for most transistors, will simplify to the following.

Measure collector voltage. If it is lower than the supply voltage, the transistor is probably conducting. With the meter still on the collector, short the base and emitter together. If the collector voltage rises to the supply voltage, the transistor is not shorted and is capable of being turned off. This simplified procedure will not work in all cases, i.e., a collector connected to ground, but as experience in servicing transistor circuits is gained, it becomes easier to see where this technique is applicable and it certainly is a fast, simple way to evaluate a transistor without removing it from the circuit.

The methods just described should be used to determine if the transistor is faulty when DC voltages indicate that the current through a stage is incorrect. If these checks indicate the transistor is normal, the bias circuits must be analyzed. This can be done by voltage and resistance measurements. When an ohmmeter is used, allowances must be made for the transistor junctions.

There are other types of circuit defects called "signal path" defects that can disable a stage and cannot be detected by DC voltage measurements. An example of this type of defect would be any one of the capacitors open in the circuits shown in Figure #46. Shorts in capacitors C-1, C-2 and C-5 can, of course, be detected in voltage measurements. Open capacitors are best located by paralleling them with similar values of capacitors.

TRANSISTOR OPERATING CLASS C

The previous material has related to the majority of transistor applications. However, in a Class C stage where collector current flows for relatively short time intervals compared to time intervals when it is not flowing, the DC voltage measurements on the transistor will differ from those measured on a Class A stage.

Figure #47 shows how the collector current will vary as a function of base voltage and input signal. The input signal is the same magnitude in all three cases. When the base voltage is .65 volts, the input signal adds to and subtracts from the base voltage and a linear output is obtained. This is Class A operation and the average collector current is a constant value. When no signal is being received, collector current is at the medium value.

When the base voltage is .5 volts, only the positive going half cycle of the input signal effectively adds to the base voltage causing an increase in collector current. The negative portion of the input signal drives the transistor into cut-off. This can be likened to Class B operation where collector current flows for only one-half the cycle when signal is applied and is at a very low or zero value when no signal is

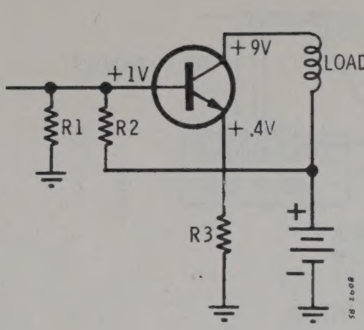


FIGURE 48A - CLASS A TRANSISTOR STAGE

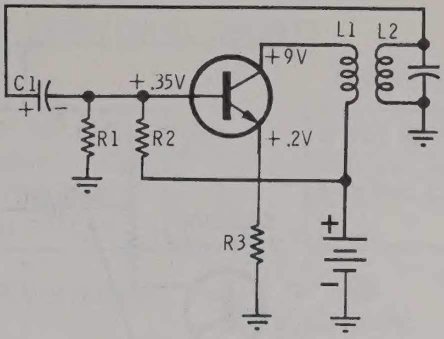


FIGURE 48B - TRANSISTOR OSCILLATOR

applied. Class B operation is often applied in battery operated devices where battery drain is an important consideration since the Class B circuit uses current in proportion to the signal being received, i.e., no signal results in little or no collector current.

When the base voltage is .4 volts, the transistor is in cut-off and no collector current flows. Only the most positive portion of the input signal causes collector current which is in pulses representing the positive peaks of the input signal. A Class C stage is usually biased into cut-off so no collector current flows until the input signal turns the stage on. Sync clippers are generally Class C stages.

It becomes apparent that the amount of base to emitter voltage or forward bias measured on a stage will be a function of whether the stage is operating Class A, B or C.

To demonstrate how voltages will vary from a Class A stage to a Class C stage, the circuit in Figure #48A can be made into an oscillator as shown in Figure #48B.

Resistors R-1 and R-2 form a voltage divider to provide +.6 volt forward bias on the base (see Figure #48B), however, at the instant that collector current starts to flow, a voltage is induced in the secondary winding of the collector coil (L-2) which is increasing in a positive direction. This positive voltage is coupled to the base by C-1 and results in an increase in forward bias which increases collector current which, in turn, increases the positive voltage developed across L-2 and more positive voltage is coupled back to the base. This action continues until collector current is maximum and no longer changing. At this time, the magnetic field around L-1 and L-2 starts to collapse which causes a negative going voltage to be developed across L-2 and this voltage coupled to the base reduces the forward bias and the transistor collector current starts to decrease which causes more negative voltage to be developed across L-2 and this continues until the transistor collector current is reduced to zero. At this time, the cycle now starts to repeat itself and the circuit becomes an oscillator.

To evaluate this overall effect on DC base voltage as measured to ground, it is necessary to evaluate the action of C-1 (Figure #48B). When the feed-back voltage is positive, electrons flow through R-3 emitter/base junction, C-1 and L-2. This charges up C-1 as shown. A discharge path for C-1 is through R-1 and since this is a higher impedance path than the charge path, the capacitor will retain a negative charge over most of the cycle. This negative charge subtracts from the forward bias and, in the circuit, a meter would read .35 volts on the base and could lead to the assumption that the transistor is "turned off" due to insufficient forward bias. In addition, a DC meter measuring emitter voltage would read .2 volts and in a Class A silicon transistor stage, a reading of .2 volts on the emitter and .35 volts on the base is indicative of a shorted transistor. However, if the stage is an oscillator, it is a normal set of readings. Base voltage is low because of the charge on C-1 and some emitter voltage is normal due to the pulses of collector current when the transistor is turned on. The meter reads the average DC value of emitter/collector voltage so it is normal to have some emitter voltage in an oscillator.

It is a good rule to consult the schematic diagram to determine the correct operating voltages. In the absence of a schematic, it becomes necessary to determine the transistor mode of operation and evaluate voltage measurements accordingly. If in doubt about a stage oscillating, it is generally an easy matter to determine if the stage is an oscillator by shorting across one of the tuned circuits. For example, a short placed across L-1 or L-2 would disable the oscillator and the stage would immediately revert to the voltages shown in the Class A operation (see Figure #48A).

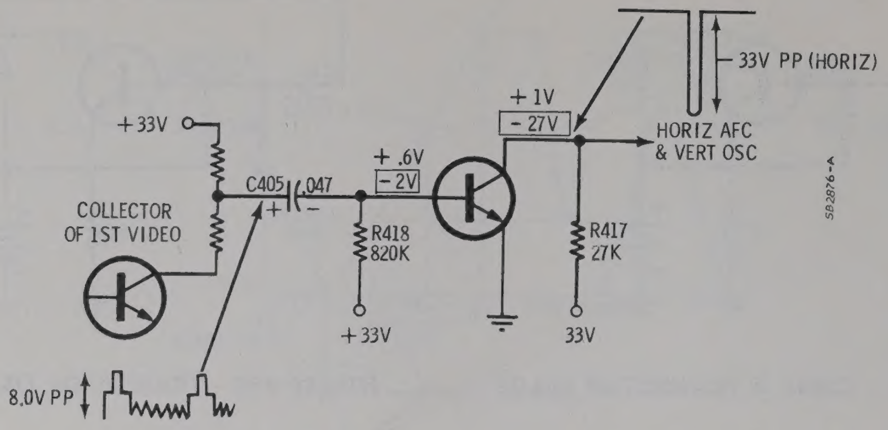


FIGURE 49 - SYNC CLIPPER CLASS C OPERATION

Other forms of Class C operation can be utilized where the stage is not an oscillator. Sync separator stages generally operate Class C as shown in Figure #49.

Voltages in the boxes represent with signal input and those on top of boxes represent no signal input (tuner set between channels). Note that with no signal input, the base/emitter is forward biased to +.6 volts as a result of electron flow through the emitter base junction and R-418. This turns the transistor on as evidenced by +1 volt on the collector and a 32 volt drop across R-417.

When the positive going video signal is applied to the base, the forward bias is increased and electrons flow through the emitter/base junction to C-405. This charges up C-405 as shown. The discharge path is through R-418, a 820K ohm resistor, so the capacitor discharges very little before it is again charged up as a result of sync pulse information. The net result is a negative charge on the capacitor that is proportional to the input signal. Only the most positive portions of the input signal are sufficient to overcome this bias and drive the transistor into conduction. Hence, only the sync pulse information, reversed 180 degrees, is seen in the collector circuit.

Note the boxed voltages representing with signal operation. The base is apparently reverse biased -2 volts with respect to the emitter and yet collector current is flowing as evidenced by the +27 volts on the collector indicating a 6 volt drop due to collector current across R-417.

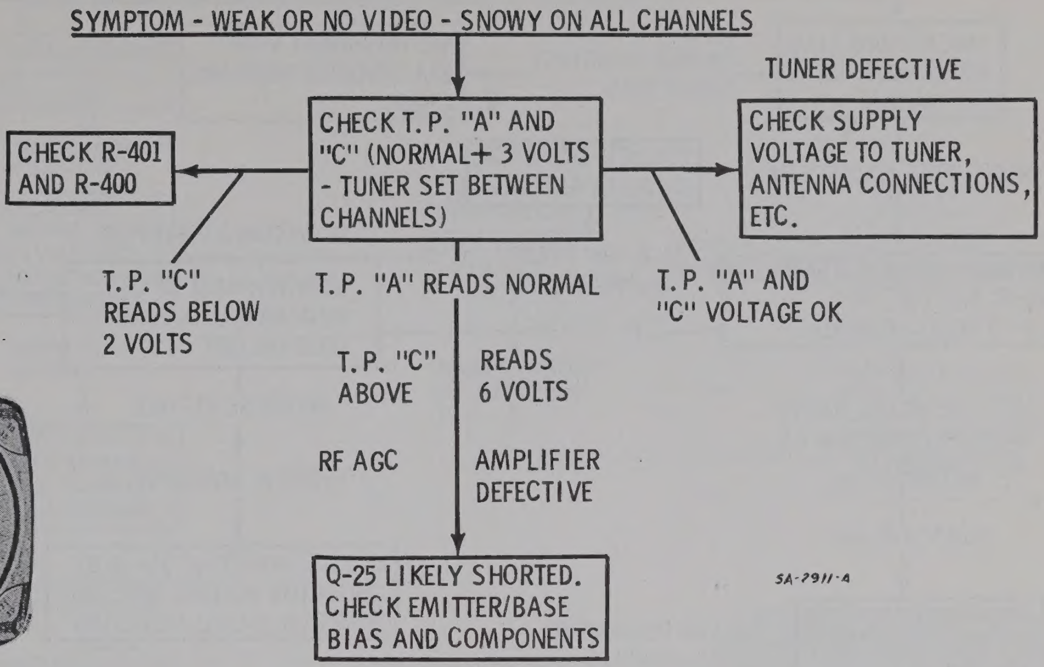
Here again, if voltages measured with signal were related to those normally encountered in Class A operation, the result could be a search for a non-existing malfunction. Once again the importance of comparing measured voltages against specified voltages is demonstrated to be a good service practice.

Incidentally, although scope checks are the best checks for a sync separator, proper bias operation can be determined by switching to a local channel (to apply signal) and an unused channel (no signal) and noting corresponding voltage changes.

It is important to note that the voltages measured will be a function of signal conditions. For example, the value of negative voltage or reverse bias will be proportional to the strength of the signal. The stronger the signal, the more negative the voltage. Also, collector voltage with no signal will be a function of noise. For example, if noise is reduced by turning the channel selector between channels, the voltage will range around 1 volt. When turned to an unused VHF channel, the collector voltage will range around 15 volts. This is due to noise charging up C-405 and reducing collector current which increases collector voltage.

TROUBLESHOOTING THE TS-458

The following troubleshooting charts have been developed to assist you in establishing a procedure for analyzing circuits in the new TS-458 solid state chassis.


SYMPTOM - WEAK OR NO VIDEO - SNOWY ON ALL CHANNELS
CHECK T. P. "A" AND "C" (NORMAL + 3 VOLTS - TUNER SET BETWEEN CHANNELS)
CHECK R-401 AND R-400
T. P. "C" READS BELOW 2 VOLTS
T. P. "A" READS NORMAL
T. P. "C" ABOVE RF AGC
READS 6 VOLTS AMPLIFIER DEFECTIVE
Q-25 LIKELY SHORTED. CHECK EMITTER/BASE BIAS AND COMPONENTS
TUNER DEFECTIVE
CHECK SUPPLY VOLTAGE TO TUNER, ANTENNA CONNECTIONS, ETC.
T. P. "A" AND "C" VOLTAGE OK
SA-2911-A

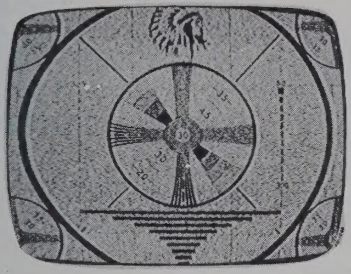


FIGURE 50 - SNOWY PICTURE

FIGURE 51 - INCORRECT TUNER AGC VOLTAGE

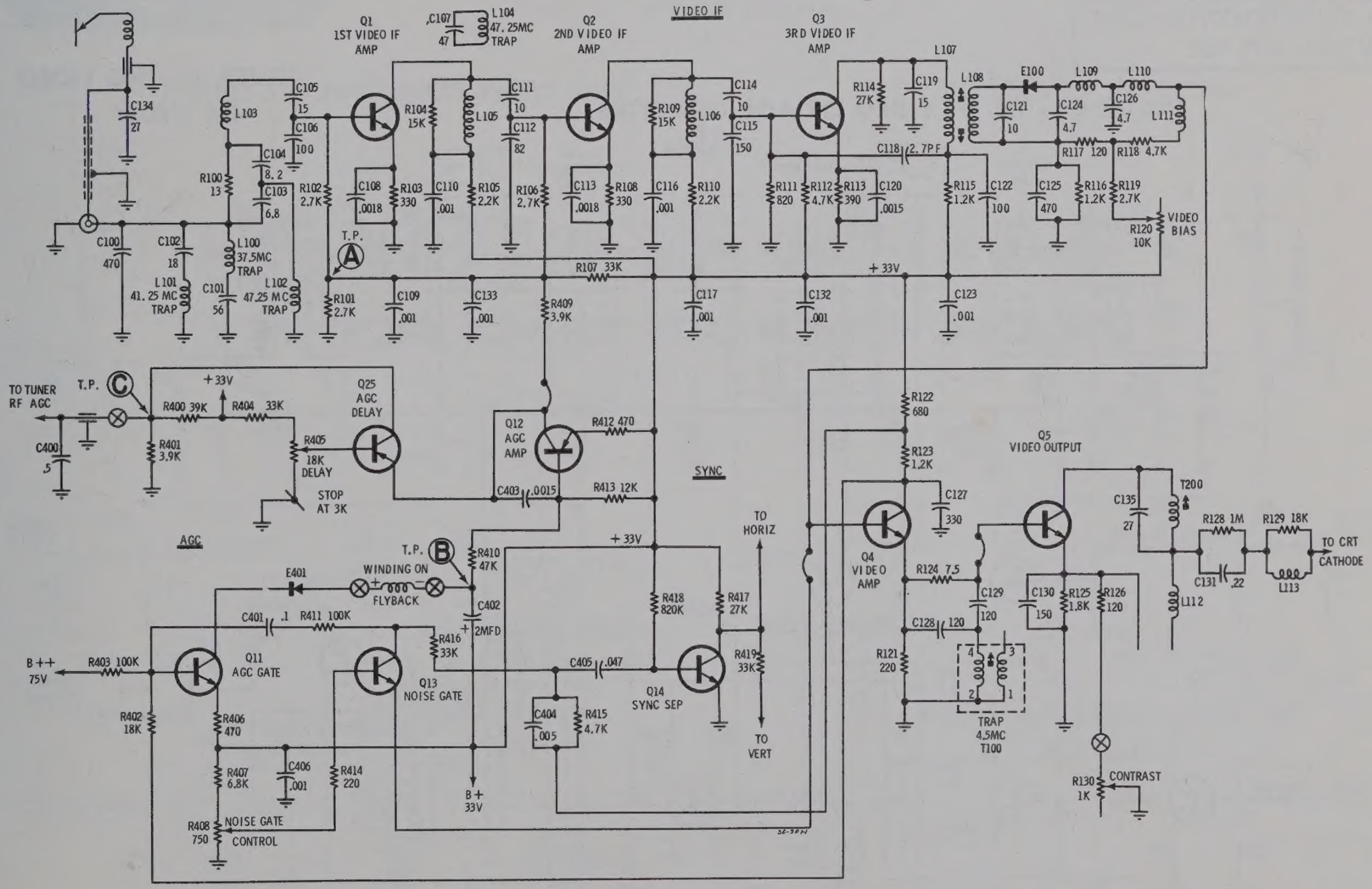
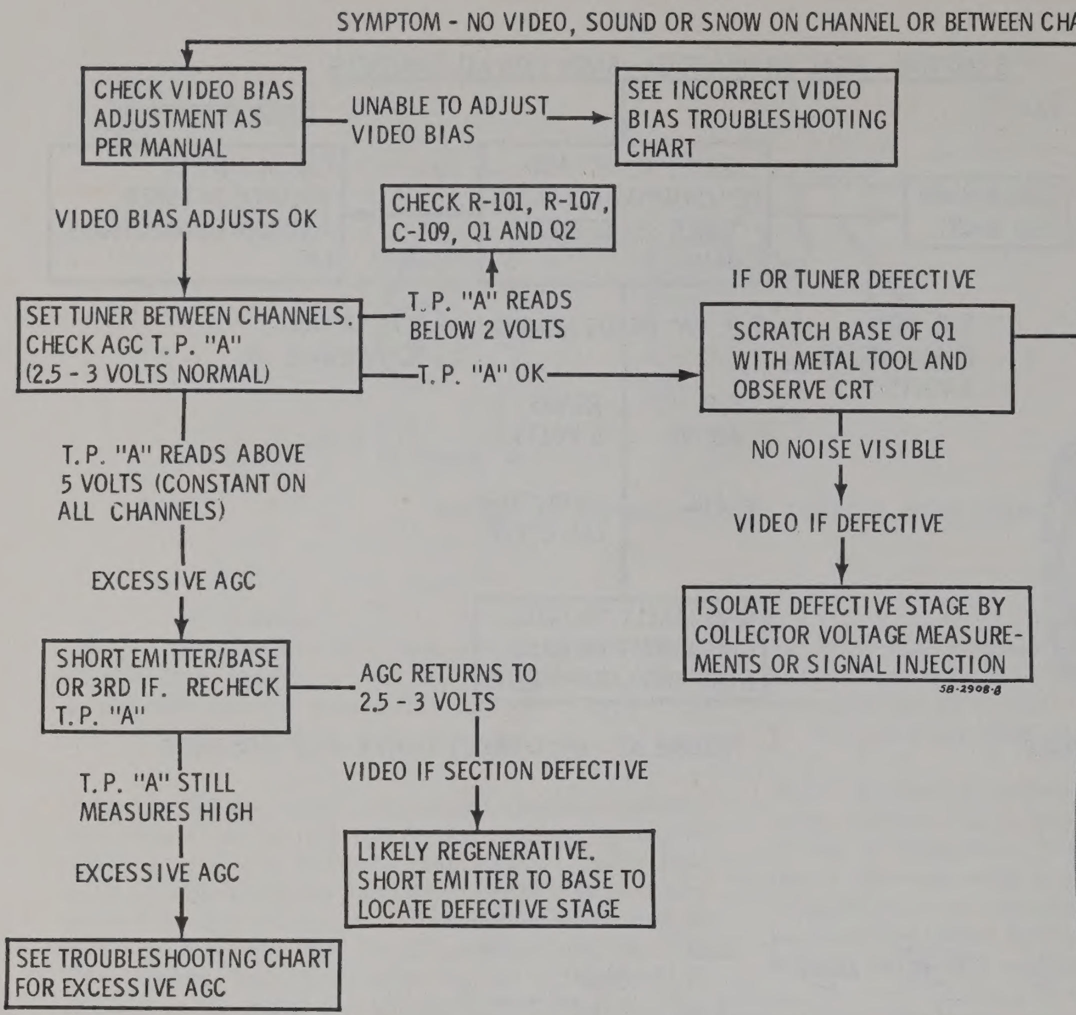

VIDEO IF
Q1 1ST VIDEO IF AMP
Q2 2ND VIDEO IF AMP
Q3 3RD VIDEO IF AMP
L104 47.25MC TRAP
C107 47
C134 27
L103
C105 15
C106 100
C104 8.2
C103 6.8
R100 13
C100 470
C102 18
L100 37.5MC TRAP
L101 41.25 MC TRAP
C101 56
L102 47.25 MC TRAP
R102 2.7K
T.P. A
R101 2.7K
C108 .0018
R103 330
R104 15K
C110 .001
L105
R105 2.2K
C111 10
C112 82
R106 2.7K
C109 .001
C133 .001
R409 3.9K
C113 .0018
R108 330
C116 .001
R109 15K
L106
R110 2.2K
C114 10
C115 150
R107 33K
C117 .001
R111 820
R112 4.7K
R113 390
C120 .0015
C132 .001
R114 27K
C119 15
L107
L108
C118 2.7PF
E100
L109
L110
C121 10
C124 4.7
C126 4.7
L111
R117 120
R118 4.7K
R115 1.2K
C122 100
C125 470
R116 1.2K
R119 2.7K
R120 10K
VIDEO BIAS
+33V
C123 .001
TO TUNER RF AGC
T.P. C
C400 .5
R400 39K
R401 3.9K
+33V
R404 33K
R405 18K DELAY
STOP AT 3K
Q25 AGC DELAY
Q12 AGC AMP
R412 470
C403 .0015
R413 12K
AGC
SYNC
T.P. B
R410 47K
WINDING ON FLYBACK
E401
C402 2MFD
+33V
C401 .1
R411 100K
R416 33K
B++ 75V
R403 100K
Q11 AGC GATE
Q13 NOISE GATE
R402 18K
R406 470
R407 6.8K
C406 .001
R414 220
R408 750 NOISE GATE CONTROL
C404 .005
R415 4.7K
C405 .047
Q14 SYNC SEP
R418 820K
R417 27K
R419 33K
TO HORIZ
TO VERT
B+ 33V
R122 680
R123 1.2K
C127 330
Q4 VIDEO AMP
R124 7.5
C129 120
C128 120
R121 220
TRAP 4.5MC T100
Q5 VIDEO OUTPUT
C135 27
T200
C130 150
R125 1.8K
R126 120
R128 1M
R129 18K
C131 .22
L113
L112
TO CRT CATHODE
R130 1K
CONTRAST

FIGURE 52 - IF, VIDEO, AGC AND SYNC


SYMPTOM - NO VIDEO, SOUND OR SNOW ON CHANNEL OR BETWEEN CHANNEL
CHECK VIDEO BIAS ADJUSTMENT AS PER MANUAL
UNABLE TO ADJUST VIDEO BIAS
SEE INCORRECT VIDEO BIAS TROUBLESHOOTING CHART
VIDEO BIAS ADJUSTS OK
CHECK R-101, R-107, C-109, Q1 AND Q2
SET TUNER BETWEEN CHANNELS. CHECK AGC T.P. "A" (2.5 - 3 VOLTS NORMAL)
T.P. "A" READS BELOW 2 VOLTS
T.P. "A" OK
IF OR TUNER DEFECTIVE
SCRATCH BASE OF Q1 WITH METAL TOOL AND OBSERVE CRT
NOISE VISIBLE
TUNER DEFECTIVE. CHECK DC SUPPLY TO TUNER, ETC.
NO NOISE VISIBLE
VIDEO IF DEFECTIVE
ISOLATE DEFECTIVE STAGE BY COLLECTOR VOLTAGE MEASUREMENTS OR SIGNAL INJECTION
5B-2908-B
T.P. "A" READS ABOVE 5 VOLTS (CONSTANT ON ALL CHANNELS)
EXCESSIVE AGC
SHORT EMITTER/BASE OR 3RD IF. RECHECK T.P. "A"
AGC RETURNS TO 2.5 - 3 VOLTS
VIDEO IF SECTION DEFECTIVE
LIKELY REGENERATIVE. SHORT EMITTER TO BASE TO LOCATE DEFECTIVE STAGE
T.P. "A" STILL MEASURES HIGH
EXCESSIVE AGC
SEE TROUBLESHOOTING CHART FOR EXCESSIVE AGC

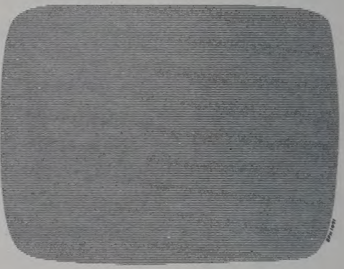


FIGURE 54 - RF, IF, VIDEO OR AGC DEFECTIVE

FIGURE 53 - NO VIDEO OR SNOW

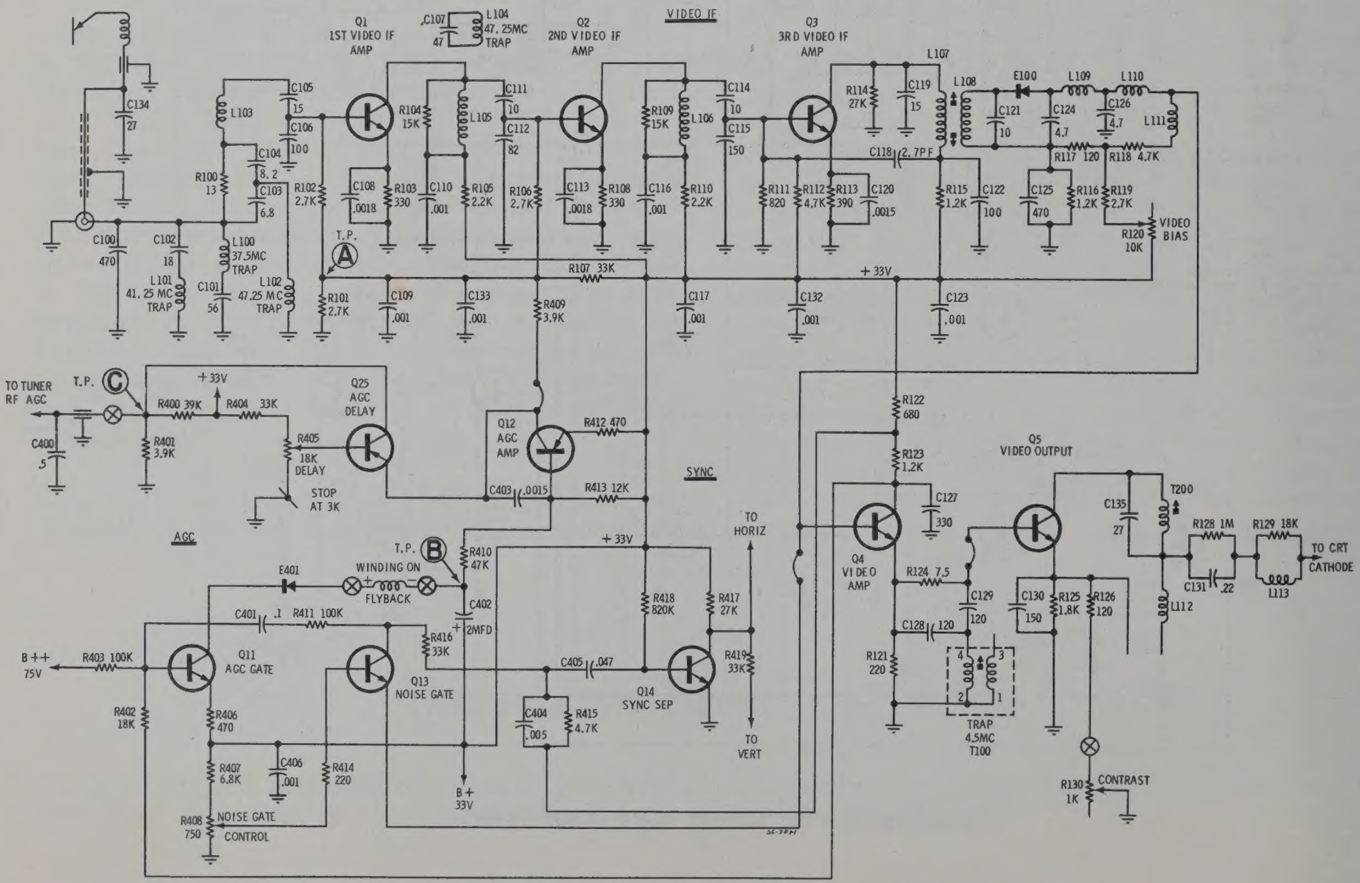

Q1 1ST VIDEO IF AMP
C107 47
L104 47.25MC TRAP
Q2 2ND VIDEO IF AMP
VIDEO IF
Q3 3RD VIDEO IF AMP
L107
C134 27
C105 15
C106 100
L103
C104 8.2
C103 6.8
R100 13
R104 15K
L105
C111 10
C112 82
R109 15K
L106
C114 10
C115 150
R114 27K
C119 15
L108
E100
L109
L110
C121 10
C124 4.7
C126 4.7
L111
C118 2.7PF
R117 120
R118 4.7K
R102 2.7K
C108 .0018
R103 330
C110 .001
R105 2.2K
R106 2.7K
C113 .0018
R108 330
C116 .001
R110 2.2K
R111 820
R112 4.7K
R113 390
C120 .0015
R115 1.2K
C122 100
C125 470
R116 1.2K
R119 2.7K
R120 10K
VIDEO BIAS
C100 470
C102 18
L100 37.5MC TRAP
T.P. A
L101 41.25 MC TRAP
C101 56
L102 47.25 MC TRAP
R101 2.7K
C109 .001
C133 .001
R107 33K
R409 3.9K
C117 .001
C132 .001
+33V
C123 .001
TO TUNER RF AGC
T.P. C
+33V
R400 39K
R404 33K
Q25 AGC DELAY
C400 .5
R401 3.9K
R405 18K DELAY
STOP AT 3K
Q12 AGC AMP
R412 470
C403 .0015
R413 12K
SYNC
R122 680
R123 1.2K
Q5 VIDEO OUTPUT
C127 330
AGC
T.P. B
R410 47K
WINDING ON FLYBACK
E401
+33V
TO HORIZ
C402 2MFD
Q4 VIDEO AMP
R124 7.5
T200
C135 27
R128 1M
R129 18K
TO CRT CATHODE
C131 .22
L113
L112
C129 120
C130 150
R125 1.8K
R126 120
C401 .1
R411 100K
R418 820K
R417 27K
C128 120
R416 33K
B++ 75V
R403 100K
Q11 AGC GATE
Q13 NOISE GATE
C405 .047
Q14 SYNC SEP
R419 33K
R121 220
TRAP 4.5MC T100
R402 18K
R406 470
C404 .005
R415 4.7K
TO VERT
R407 6.8K
C406 .001
R414 220
B+ 33V
R130 1K
CONTRAST
R408 750
NOISE GATE CONTROL

FIGURE 55 - IF, VIDEO, AGC AND SYNC

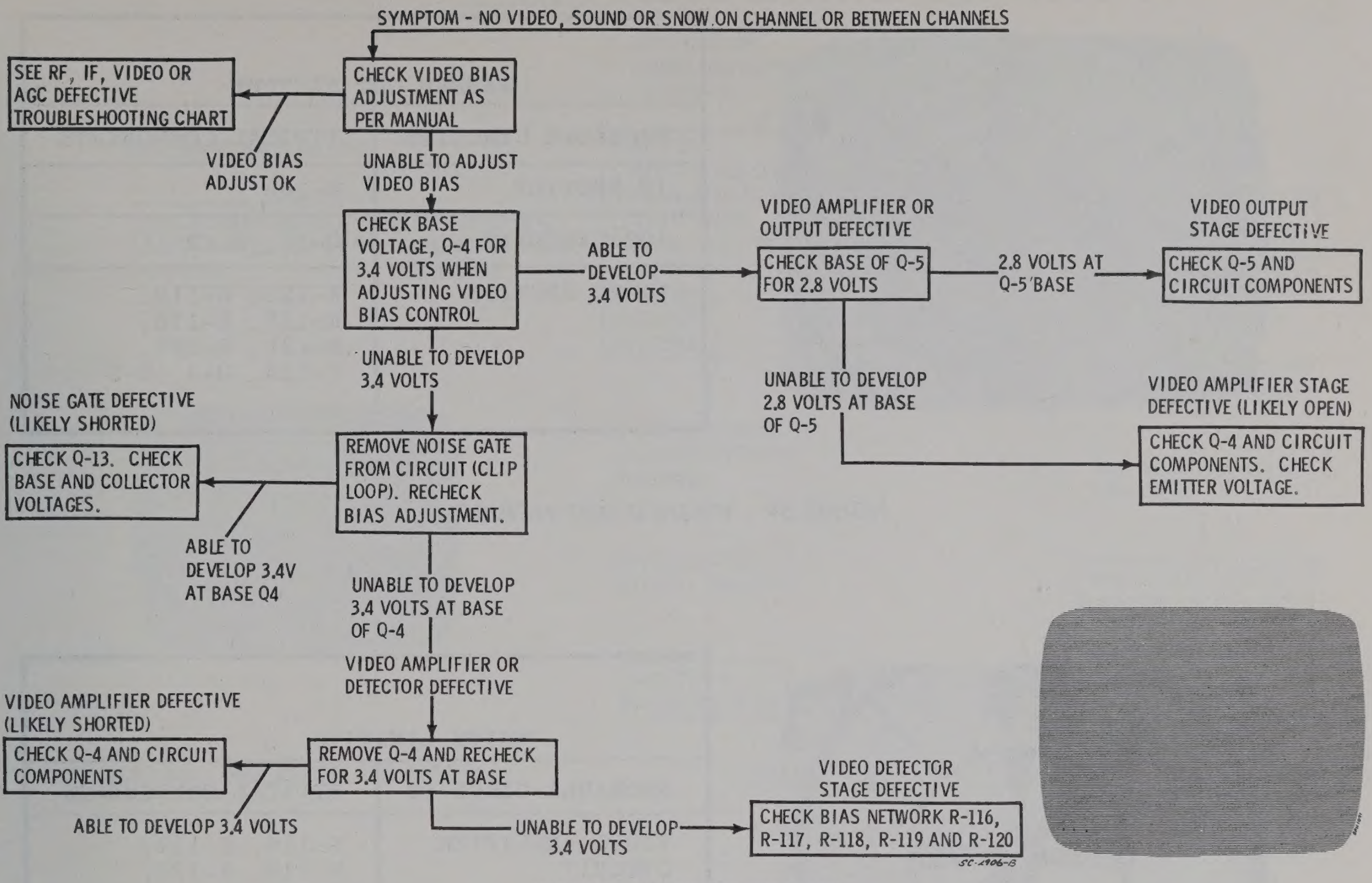

SYMPTOM - NO VIDEO, SOUND OR SNOW ON CHANNEL OR BETWEEN CHANNELS
CHECK VIDEO BIAS ADJUSTMENT AS PER MANUAL
VIDEO BIAS ADJUST OK
SEE RF, IF, VIDEO OR AGC DEFECTIVE TROUBLESHOOTING CHART
UNABLE TO ADJUST VIDEO BIAS
CHECK BASE VOLTAGE, Q-4 FOR 3.4 VOLTS WHEN ADJUSTING VIDEO BIAS CONTROL
ABLE TO DEVELOP 3.4 VOLTS
VIDEO AMPLIFIER OR OUTPUT DEFECTIVE
CHECK BASE OF Q-5 FOR 2.8 VOLTS
2.8 VOLTS AT Q-5 BASE
VIDEO OUTPUT STAGE DEFECTIVE
CHECK Q-5 AND CIRCUIT COMPONENTS
UNABLE TO DEVELOP 2.8 VOLTS AT BASE OF Q-5
VIDEO AMPLIFIER STAGE DEFECTIVE (LIKELY OPEN)
CHECK Q-4 AND CIRCUIT COMPONENTS. CHECK EMITTER VOLTAGE.
UNABLE TO DEVELOP 3.4 VOLTS
NOISE GATE DEFECTIVE (LIKELY SHORTED)
CHECK Q-13. CHECK BASE AND COLLECTOR VOLTAGES.
REMOVE NOISE GATE FROM CIRCUIT (CLIP LOOP). RECHECK BIAS ADJUSTMENT.
ABLE TO DEVELOP 3.4V AT BASE Q4
UNABLE TO DEVELOP 3.4 VOLTS AT BASE OF Q-4
VIDEO AMPLIFIER OR DETECTOR DEFECTIVE
VIDEO AMPLIFIER DEFECTIVE (LIKELY SHORTED)
CHECK Q-4 AND CIRCUIT COMPONENTS
REMOVE Q-4 AND RECHECK FOR 3.4 VOLTS AT BASE
ABLE TO DEVELOP 3.4 VOLTS
UNABLE TO DEVELOP 3.4 VOLTS
VIDEO DETECTOR STAGE DEFECTIVE
CHECK BIAS NETWORK R-116, R-117, R-118, R-119 AND R-120
SC-2906-B

FIGURE 57 INCORRECT VIDEO BIAS

FIGURE 57 - INCORRECT VIDEO BIAS

FIGURE 56 - NO VIDEO

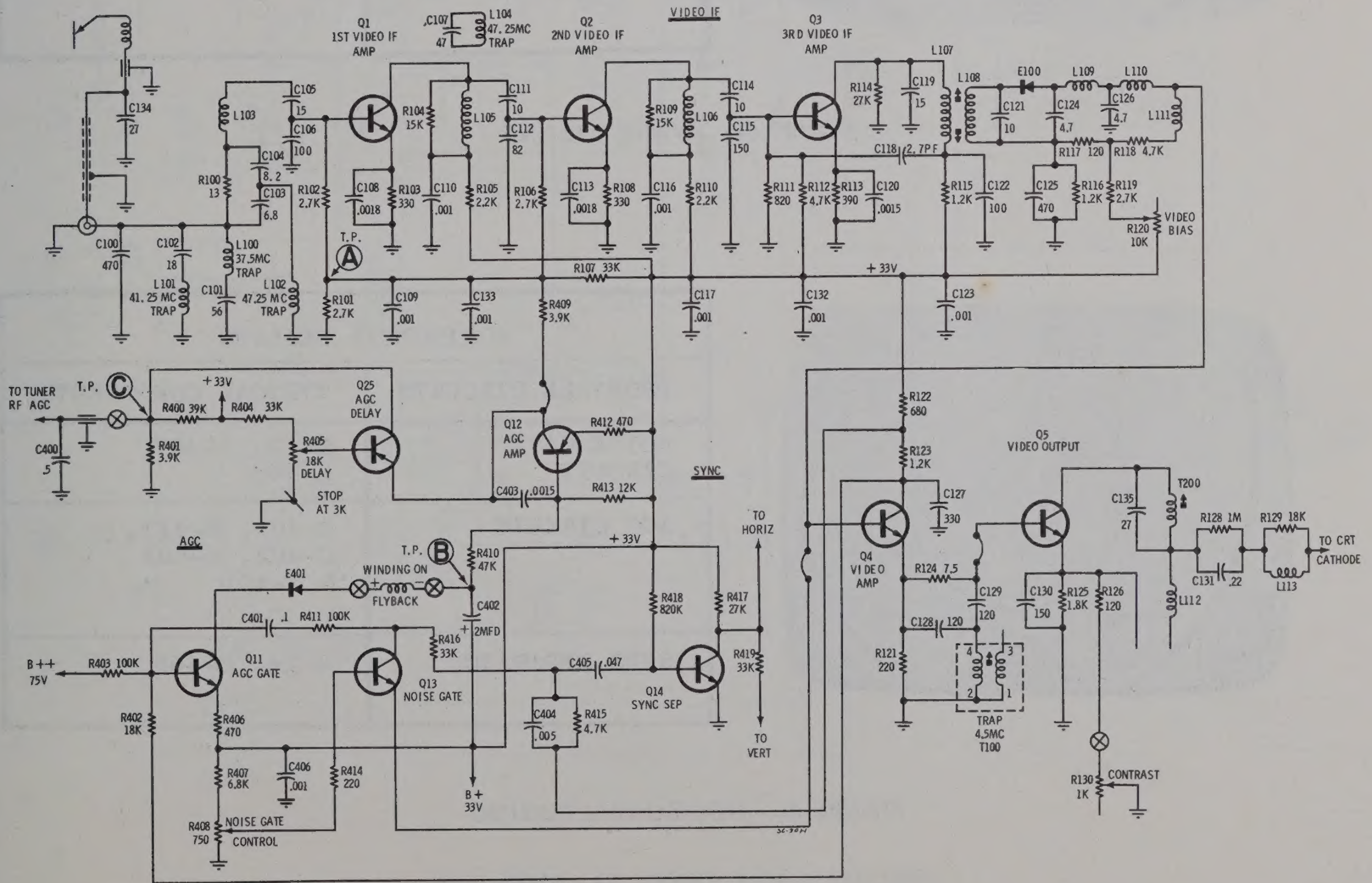
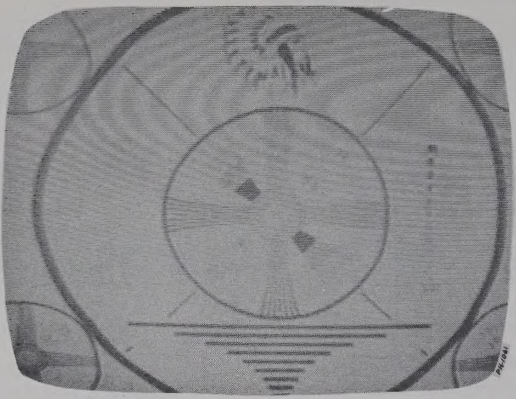
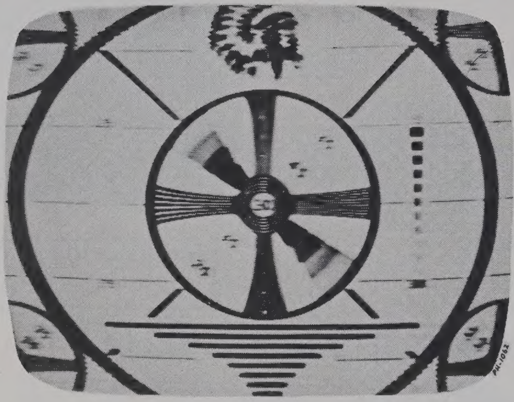

VIDEO IF
Q1 1ST VIDEO IF AMP
Q2 2ND VIDEO IF AMP
Q3 3RD VIDEO IF AMP
C107 47
L104 47.25MC TRAP
L107
L108
E100
L109
L110
L111
C134 27
L103
C105 15
C106 100
C104 8.2
C103 6.8
R100 13
R102 2.7K
C100 470
C102 18
L100 37.5MC TRAP
L101 41.25 MC TRAP
C101 56
L102 47.25 MC TRAP
T.P. A
R101 2.7K
C108 .0018
R103 330
C110 .001
R104 15K
L105
C111 10
C112 82
R105 2.2K
R106 2.7K
C109 .001
C133 .001
C113 .0018
R108 330
R109 15K
L106
C114 10
C115 150
C116 .001
R110 2.2K
R107 33K
R409 3.9K
C117 .001
R111 820
R112 4.7K
R113 390
C120 .0015
R114 27K
C119 15
C118 2.7PF
C121 10
C124 4.7
C126 4.7
R117 120
R118 4.7K
R115 1.2K
C122 100
C125 470
R116 1.2K
R119 2.7K
R120 10K
VIDEO BIAS
+33V
C132 .001
C123 .001
TO TUNER RF AGC
T.P. C
C400 .5
R400 39K
R401 3.9K
+33V
R404 33K
R405 18K DELAY
STOP AT 3K
Q25 AGC DELAY
Q12 AGC AMP
R412 470
C403 .0015
R413 12K
SYNC
AGC
T.P. B
E401
WINDING ON FLYBACK
R410 47K
C402 2MFD
+33V
C401 .1
R411 100K
R416 33K
B++ 75V
R403 100K
Q11 AGC GATE
Q13 NOISE GATE
R402 18K
R406 470
R407 6.8K
C406 .001
R414 220
R408 750 NOISE GATE CONTROL
B+ 33V
C404 .005
R415 4.7K
C405 .047
R418 820K
R417 27K
Q14 SYNC SEP
R419 33K
TO HORIZ
TO VERT
R122 680
R123 1.2K
C127 330
Q4 VIDEO AMP
Q5 VIDEO OUTPUT
R124 7.5
C129 120
C128 120
R121 220
TRAP 4.5MC T100
C130 150
R125 1.8K
R126 120
C135 27
T200
L112
R128 1M
R129 18K
C131 .22
L113
TO CRT CATHODE
R130 1K CONTRAST
SC-3011

FIGURE 58 - IF, VIDEO, AGC AND SYNC



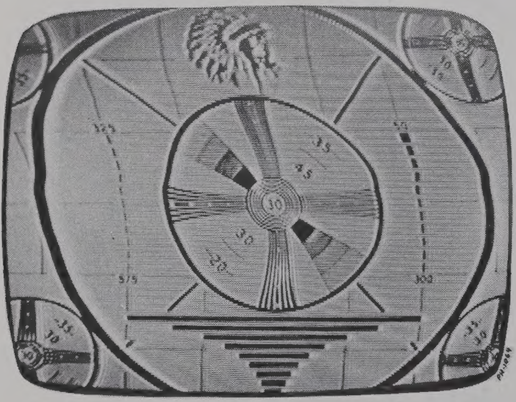
WASHED OUT PICTURE	
PROBABLE CIRCUITS	TYPICAL COMPONENTS
IF SECTION	E-100
AGC CIRCUITS	Q-11, Q-12
VIDEO SECTION	R-120, R-119, R-117, R-116, R-121, R-127, C-125, Q-4, Q-5

FIGURE 59 - WASHED OUT PICTURE



WHITE LIMITING	
PROBABLE CIRCUITS	TYPICAL COMPONENTS
VIDEO AMPLIFIER CIRCUIT	R-116, R-117, R-119, R-120, R-121
VIDEO OUTPUT CIRCUIT	L-112, R-127

FIGURE 60 - WHITE LIMITING



HORIZONTAL PULLING	
PROBABLE CIRCUITS	TYPICAL COMPONENTS
NOISE GATE CIRCUIT	Q-13, R-407, R-408
AGC CIRCUIT	R-409, R-413, C-402, C-403 & E-401
SYNC SEPARATOR	Q-14, C-405

FIGURE 61 - HORIZONTAL PULLING

SYMPTOM - NO VIDEO, SOUND OR SNOW ON ANY CHANNEL

T.P. "A" AND T.P. "C" VOLTAGES TOO HIGH OFF CHANNEL. REMOVE LEAD FROM T.P. "B" ON H.O.T.

T.P. "A" AND T.P. "C" RETURNS TO NORMAL

AGC GATE OR VIDEO AMPLIFIER DEFECTIVE

CHECK Q-4 COLLECTOR VOLTAGE. SHOULD BE 10 TO 15 VOLTS WITH EMITTER/BASE, 3RD IF SHORTED AND VIDEO BIAS PROPERLY ADJUSTED

VIDEO AMPLIFIER COLLECTOR VOLTAGE OK

CHECK EMITTER/BASE BIAS, Q-11 (LIKELY SHORTED)

AGC GATE STAGE DEFECTIVE

VIDEO AMPLIFIER COLLECTOR VOLTAGE TOO HIGH

Q-4 COLLECTOR CIRCUIT DEFECTIVE

CHECK Q-4 R-122 AND R-123

VOLTAGE AT T.P. "A" AND T.P. "C" REMAIN HIGH

AGC AMPLIFIER STAGE DEFECTIVE

Q-12 LIKELY SHORTED - MEASURE EMITTER/BASE BIAS. CHECK R-413, R-410, R-409 AND OTHER RELATED COMPONENTS

SB-2309-A

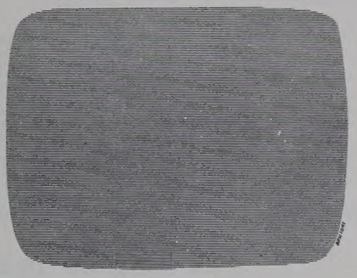


FIGURE 62 - NO VIDEO OR SNOW

FIGURE 63 - EXCESSIVE AGC

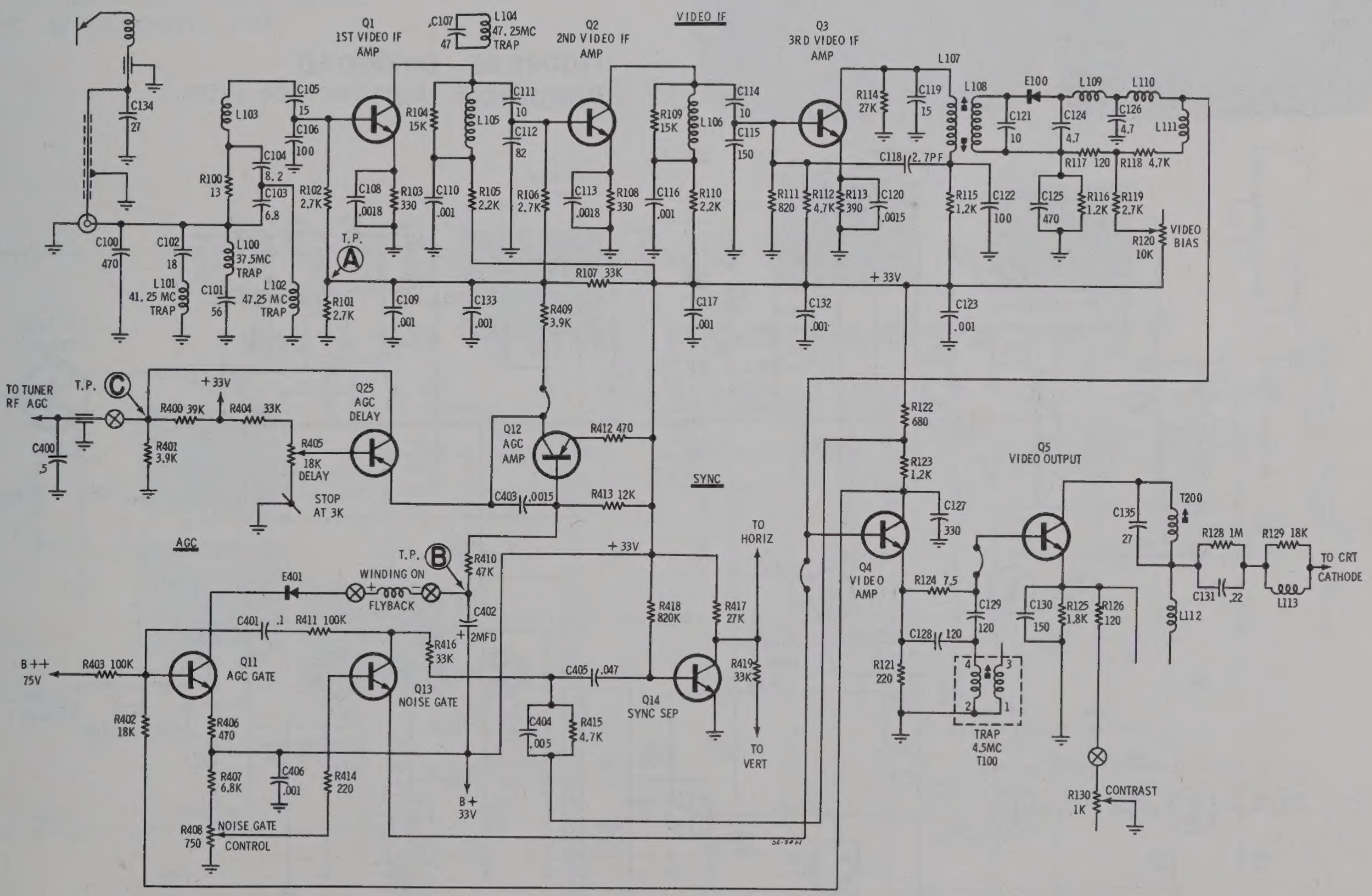
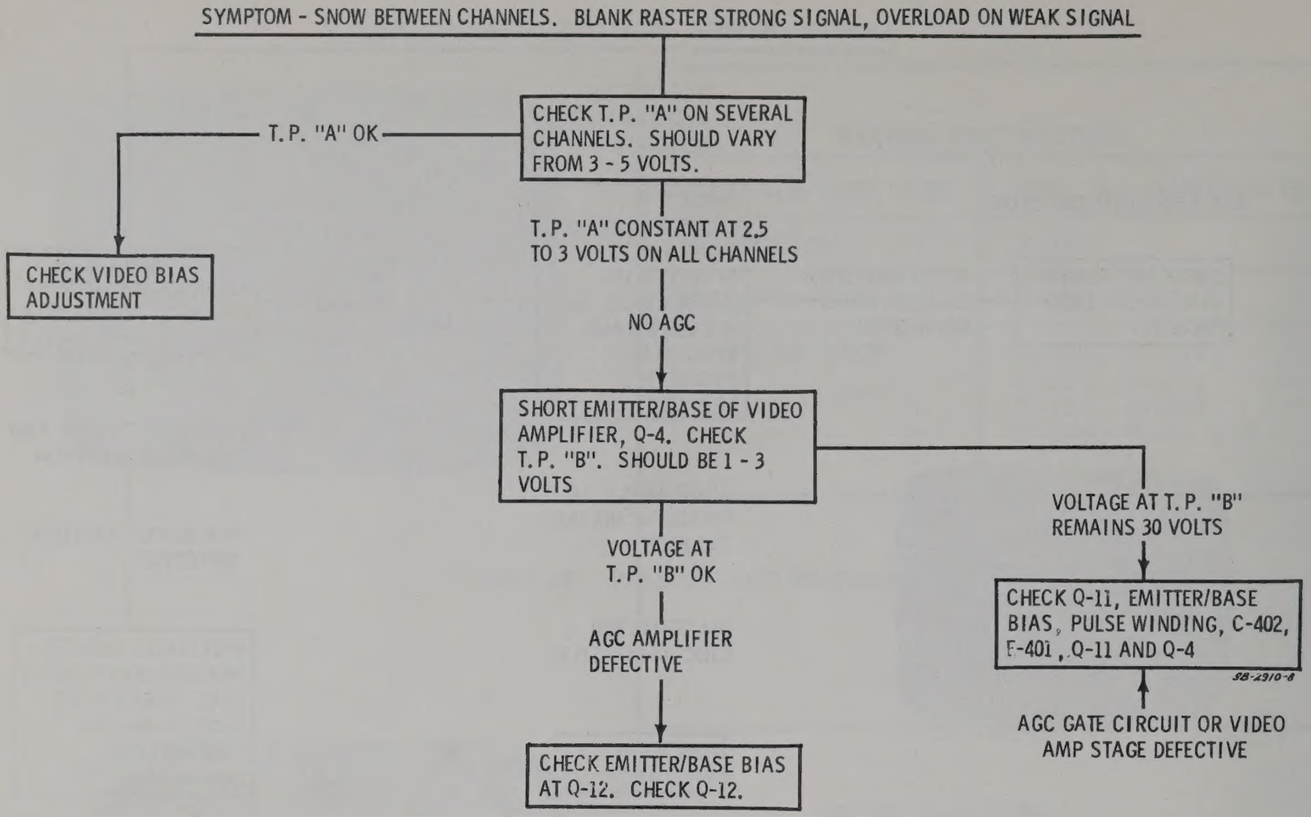
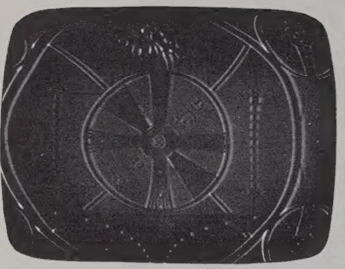

Q1
1ST VIDEO IF AMP
C107 47
L104 47.25MC TRAP
Q2
2ND VIDEO IF AMP
VIDEO IF
Q3
3RD VIDEO IF AMP
L107
L108
E100
L109
L110
L111
C134 27
L103
C105 15
C106 100
C104 8.2
C103 6.8
R100 13
R102 2.7K
C100 470
C102 18
L100 37.5MC TRAP
L101 41.25 MC TRAP
C101 56
L102 47.25 MC TRAP
T.P. A
R101 2.7K
R104 15K
L105
C108 .0018
R103 330
C110 .001
R105 2.2K
C111 10
C112 82
R106 2.7K
C113 .0018
R108 330
C116 .001
R109 15K
L106
R110 2.2K
C114 10
C115 150
R114 27K
C119 15
C118 2.7PF
R111 820
R112 4.7K
R113 390
C120 .0015
R115 1.2K
C122 100
C121 10
C124 4.7
C126 4.7
R117 120
R118 4.7K
C125 470
R116 1.2K
R119 2.7K
R120 10K
VIDEO BIAS
R107 33K
C109 .001
C133 .001
C117 .001
C132 .001
C123 .001
+33V
R409 3.9K
TO TUNER RF AGC
T.P. C
+33V
R400 39K
R404 33K
C400 .5
R401 3.9K
R405 18K DELAY
STOP AT 3K
Q25 AGC DELAY
Q12 AGC AMP
R412 470
C403 .0015
R413 12K
SYNC
AGC
T.P. B
E401
WINDING ON FLYBACK
R410 47K
C402 2MFD
+33V
C401 .1
R411 100K
R416 33K
B++ 75V
R403 100K
Q11 AGC GATE
Q13 NOISE GATE
C405 .047
Q14 SYNC SEP
R418 820K
R417 27K
R419 33K
TO HORIZ
TO VERT
R402 18K
R406 470
C404 .005
R415 4.7K
R407 6.8K
C406 .001
R414 220
B+ 33V
R408 750
NOISE GATE CONTROL
R122 680
R123 1.2K
C127 330
Q4 VIDEO AMP
R124 7.5
C129 120
C128 120
R121 220
TRAP 4.5MC T100
Q5 VIDEO OUTPUT
C135 27
T200
R128 1M
R129 18K
TO CRT CATHODE
C131 .22
L113
L112
C130 150
R125 1.8K
R126 120
R130 1K
CONTRAST

FIGURE 64 - IF, VIDEO, AGC AND SYNC


SYMPTOM - SNOW BETWEEN CHANNELS. BLANK RASTER STRONG SIGNAL, OVERLOAD ON WEAK SIGNAL
CHECK T. P. "A" ON SEVERAL CHANNELS. SHOULD VARY FROM 3 - 5 VOLTS.
T. P. "A" OK
CHECK VIDEO BIAS ADJUSTMENT
T. P. "A" CONSTANT AT 2.5 TO 3 VOLTS ON ALL CHANNELS
NO AGC
SHORT EMITTER/BASE OF VIDEO AMPLIFIER, Q-4. CHECK T. P. "B". SHOULD BE 1 - 3 VOLTS
VOLTAGE AT T. P. "B" REMAINS 30 VOLTS
CHECK Q-11, EMITTER/BASE BIAS, PULSE WINDING, C-402, E-401, Q-11 AND Q-4
SB-2310-8
AGC GATE CIRCUIT OR VIDEO AMP STAGE DEFECTIVE
VOLTAGE AT T. P. "B" OK
AGC AMPLIFIER DEFECTIVE
CHECK EMITTER/BASE BIAS AT Q-12. CHECK Q-12.



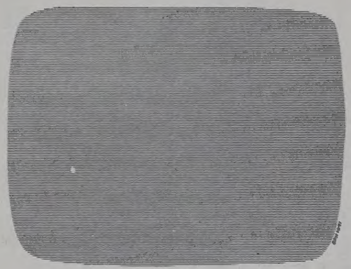


FIGURE 66 - NO AGC

FIGURE 65 - OVERLOAD CONDITION

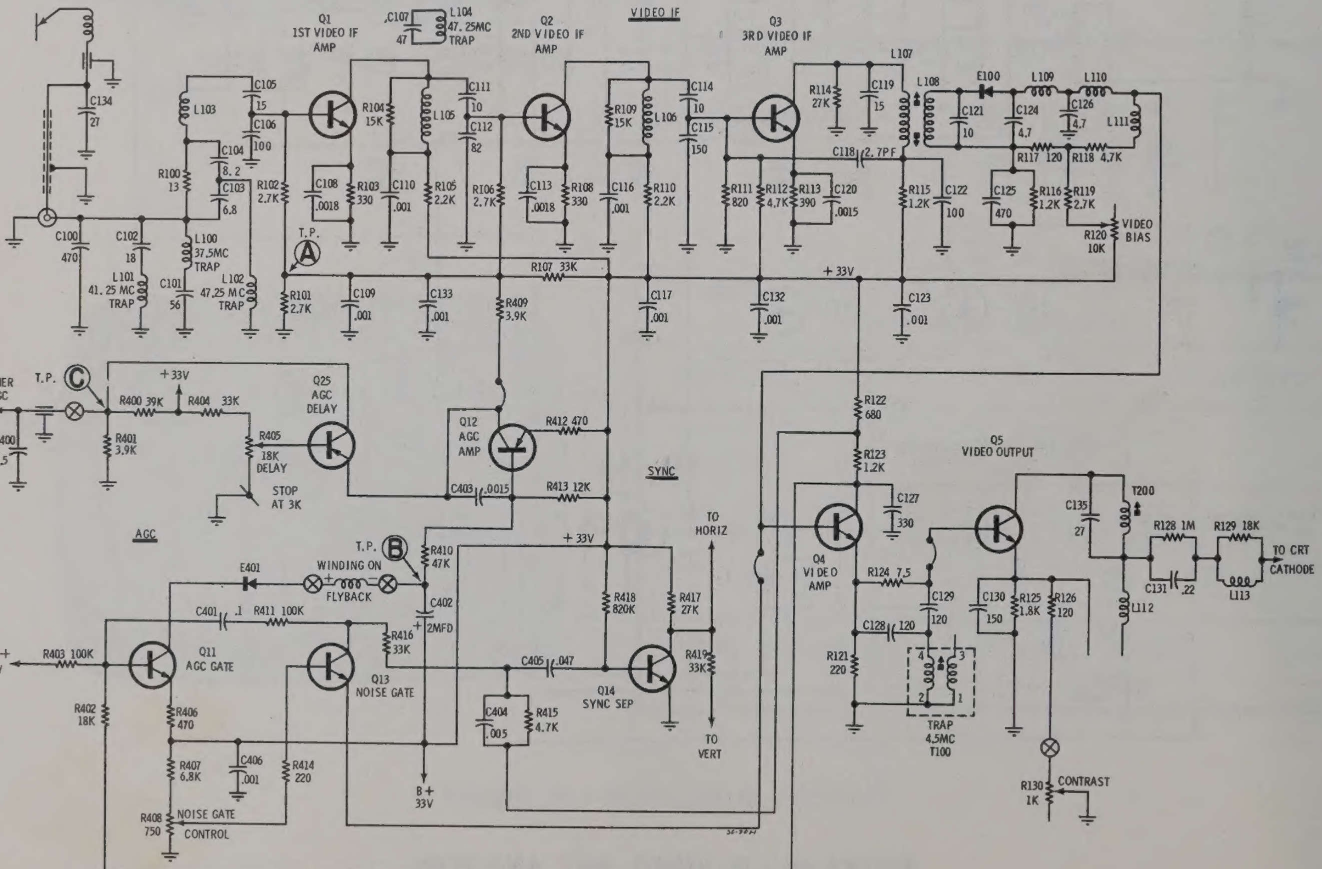
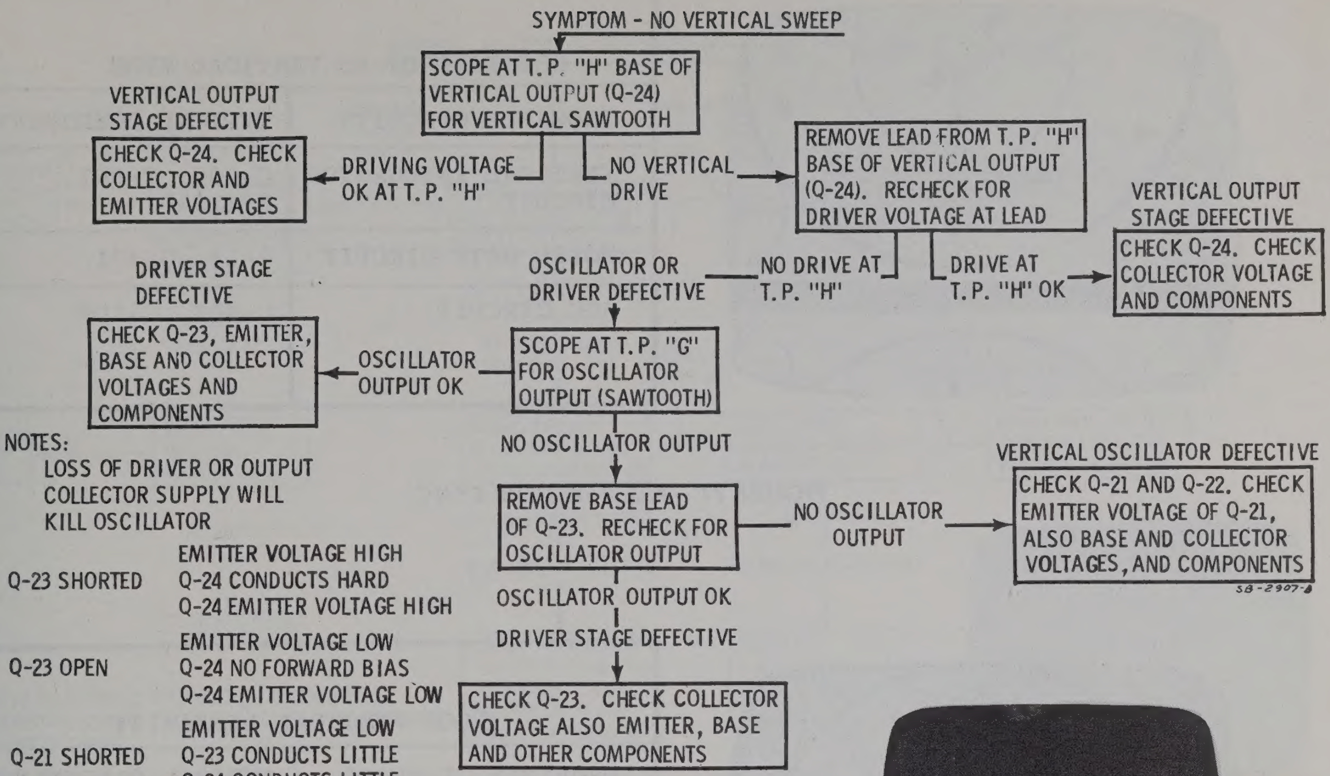

VIDEO IF
Q1 1ST VIDEO IF AMP
Q2 2ND VIDEO IF AMP
Q3 3RD VIDEO IF AMP
C107 47
L104 47.25MC TRAP
C134 27
L103
C105 15
C106 100
C104 8.2
C103 6.8
R100 13
C100 470
C102 18
L101 41.25 MC TRAP
L100 37.5MC TRAP
C101 56
L102 47.25 MC TRAP
T.P. A
R101 2.7K
R102 2.7K
C108 .0018
R103 330
R104 15K
C110 .001
L105
R105 2.2K
C111 10
C112 82
R106 2.7K
C113 .0018
R108 330
R109 15K
C116 .001
L106
R110 2.2K
C114 10
C115 150
R111 820
R112 4.7K
R113 390
C120 .0015
R114 27K
C119 15
L107
L108
E100
L109
L110
C121 10
C124 4.7
C126 4.7
L111
C118 2.7PF
R117 120
R118 4.7K
R115 1.2K
C122 100
C125 470
R116 1.2K
R119 2.7K
R120 10K VIDEO BIAS
R107 33K
+33V
C109 .001
C133 .001
R409 3.9K
C117 .001
C132 .001
C123 .001
TO TUNER RF AGC
T.P. C
+33V
R400 39K
R404 33K
Q25 AGC DELAY
C400 .5
R401 3.9K
R405 18K DELAY
STOP AT 3K
Q12 AGC AMP
R412 470
C403 .0015
R413 12K
SYNC
R122 680
R123 1.2K
Q5 VIDEO OUTPUT
AGC
T.P. B
E401
WINDING ON FLYBACK
R410 47K
C402 2MFD
+33V
TO HORIZ
C127 330
Q4 VIDEO AMP
R124 7.5
C129 120
C135 27
T200
R128 1M
R129 18K
TO CRT CATHODE
C131 .22
L113
L112
C130 150
R125 1.8K
R126 120
C128 120
R121 220
TRAP 4.5MC T100
C401 .1
R411 100K
R416 33K
R418 820K
R417 27K
B++ 75V
R403 100K
Q11 AGC GATE
Q13 NOISE GATE
C405 .047
Q14 SYNC SEP
R419 33K
R402 18K
R406 470
C404 .005
R415 4.7K
TO VERT
R407 6.8K
C406 .001
R414 220
B+ 33V
R408 750 NOISE GATE CONTROL
R130 1K CONTRAST

FIGURE 67 - IF, VIDEO, AGC AND SYNC


SYMPTOM - NO VERTICAL SWEEP
SCOPE AT T.P. "H" BASE OF VERTICAL OUTPUT (Q-24) FOR VERTICAL SAWTOOTH
VERTICAL OUTPUT STAGE DEFECTIVE
CHECK Q-24. CHECK COLLECTOR AND EMITTER VOLTAGES
DRIVING VOLTAGE OK AT T.P. "H"
NO VERTICAL DRIVE
REMOVE LEAD FROM T.P. "H" BASE OF VERTICAL OUTPUT (Q-24). RECHECK FOR DRIVER VOLTAGE AT LEAD
VERTICAL OUTPUT STAGE DEFECTIVE
CHECK Q-24. CHECK COLLECTOR VOLTAGE AND COMPONENTS
DRIVE AT T.P. "H" OK
NO DRIVE AT T.P. "H"
OSCILLATOR OR DRIVER DEFECTIVE
DRIVER STAGE DEFECTIVE
CHECK Q-23, EMITTER, BASE AND COLLECTOR VOLTAGES AND COMPONENTS
OSCILLATOR OUTPUT OK
SCOPE AT T.P. "G" FOR OSCILLATOR OUTPUT (SAWTOOTH)
NO OSCILLATOR OUTPUT
REMOVE BASE LEAD OF Q-23. RECHECK FOR OSCILLATOR OUTPUT
NO OSCILLATOR OUTPUT
VERTICAL OSCILLATOR DEFECTIVE
CHECK Q-21 AND Q-22. CHECK EMITTER VOLTAGE OF Q-21, ALSO BASE AND COLLECTOR VOLTAGES, AND COMPONENTS
SB-2907-B
OSCILLATOR OUTPUT OK
DRIVER STAGE DEFECTIVE
CHECK Q-23. CHECK COLLECTOR VOLTAGE ALSO EMITTER, BASE AND OTHER COMPONENTS

NOTES:
LOSS OF DRIVER OR OUTPUT COLLECTOR SUPPLY WILL KILL OSCILLATOR

Q-23 SHORTED	EMITTER VOLTAGE HIGH Q-24 CONDUCTS HARD Q-24 EMITTER VOLTAGE HIGH
Q-23 OPEN	EMITTER VOLTAGE LOW Q-24 NO FORWARD BIAS Q-24 EMITTER VOLTAGE LOW
Q-21 SHORTED	EMITTER VOLTAGE LOW Q-23 CONDUCTS LITTLE Q-24 CONDUCTS LITTLE
Q-21 OPEN	EMITTER VOLTAGE HIGH Q-23 CONDUCTS HIGH Q-24 CONDUCTS HIGH

NONE OF THESE CONDITIONS WILL DESTROY OUTPUT, Q-24.

FIGURE 69 - VERTICAL SWEEP DEFECTIVE

FIGURE 68 - NO VERTICAL SWEEP

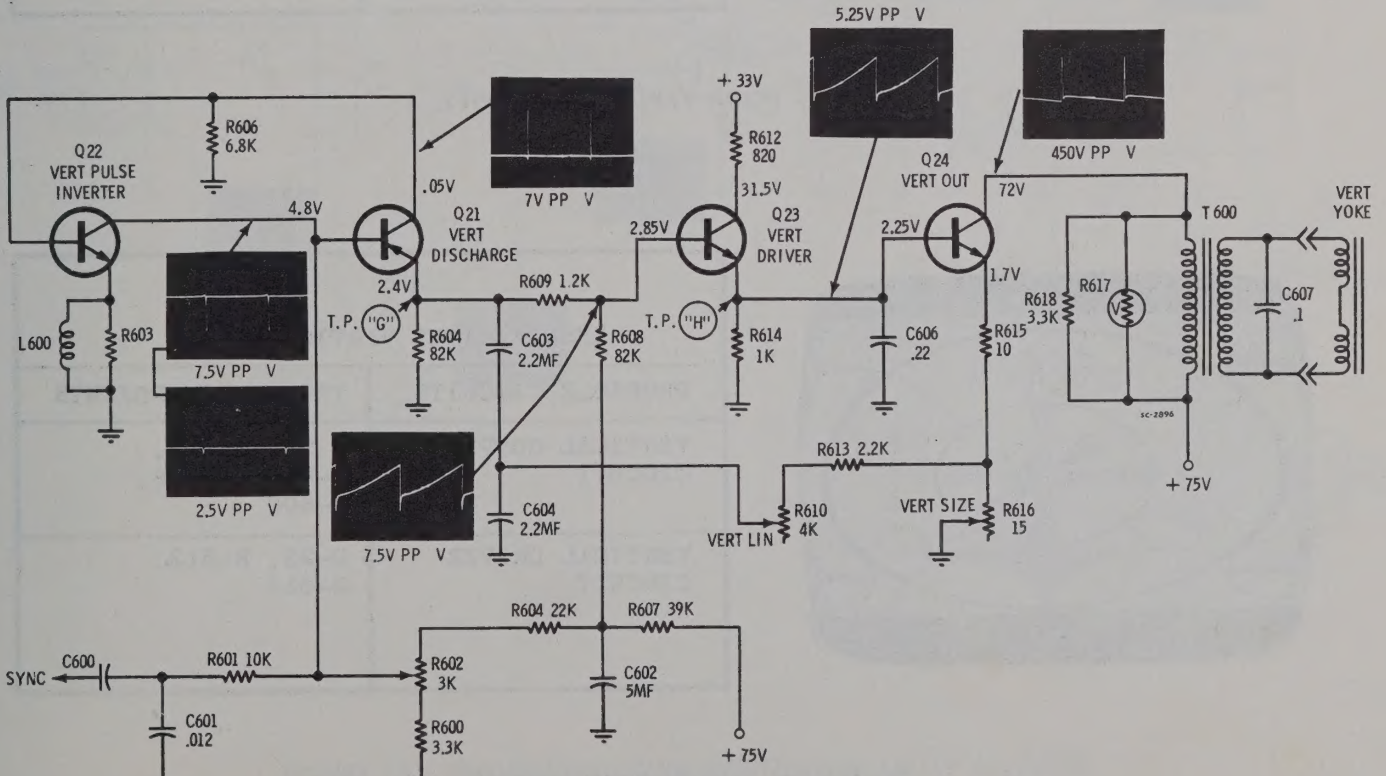
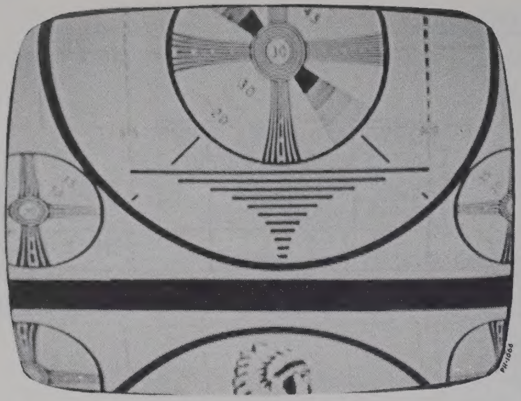
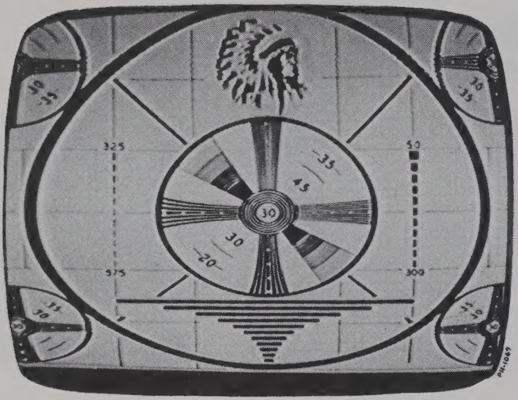

5.25V PP V
450V PP V
+ 33V
R612 820
31.5V
R606 6.8K
Q22 VERT PULSE INVERTER
.05V
7V PP V
Q24 VERT OUT
72V
T 600
VERT YOKE
4.8V
Q21 VERT DISCHARGE
2.85V
Q23 VERT DRIVER
2.25V
2.4V
R609 1.2K
1.7V
R618 3.3K
R617
C607 .1
T.P. "G"
T.P. "H"
L600
R603
R604 82K
C603 2.2MF
R608 82K
R614 1K
C606 .22
R615 10
7.5V PP V
SC-2896
R613 2.2K
+ 75V
2.5V PP V
C604 2.2MF
R610 4K
VERT LIN
VERT SIZE
R616 15
7.5V PP V
R604 22K
R607 39K
C600
SYNC
R601 10K
R602 3K
C601 .012
C602 5MF
R600 3.3K
+ 75V

FIGURE 70 - COMPLETE VERTICAL OSCILLATOR AND OUTPUT CIRCUIT



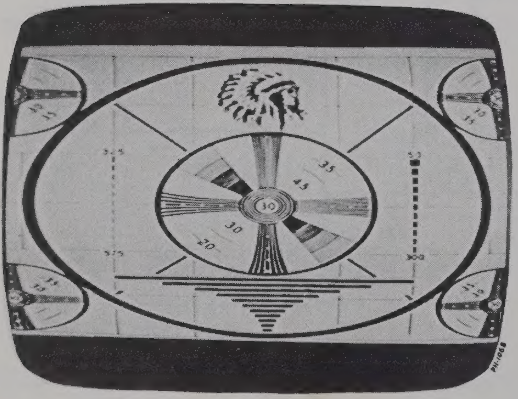
CRITICAL OR NO VERTICAL SYNC	
PROBABLE CIRCUITS	TYPICAL COMPONENTS
VERTICAL INTEGRATOR CIRCUIT	C-606, C-601, R-419
NOISE GATE CIRCUIT	Q-13, C-401
AGC CIRCUIT	C-403, C-109

FIGURE 71 - NO VERTICAL SYNC



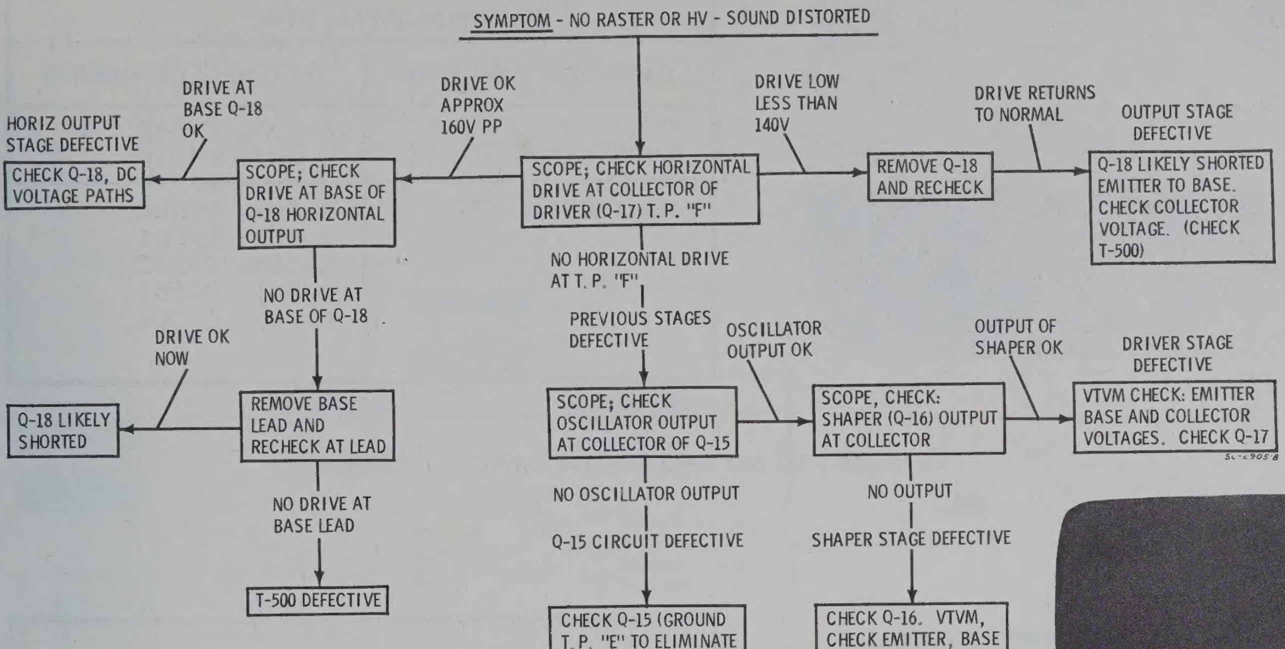
POOR VERTICAL LINEARITY	
PROBABLE CIRCUITS	TYPICAL COMPONENTS
VERTICAL OUTPUT CIRCUIT	Q-24, C-605, R-610, R-611, R-613
VERTICAL DRIVER	Q-23, C-605, R-610, R-611, R-613

FIGURE 72 - POOR VERTICAL LINEARITY



INSUFFICIENT VERTICAL SWEEP	
PROBABLE CIRCUITS	TYPICAL COMPONENTS
VERTICAL OUTPUT CIRCUIT	Q-24, R-615, R-616, R-618, C-606
VERTICAL DRIVER CIRCUIT	Q-23, R-612, R-614

FIGURE 73 - INSUFFICIENT HEIGHT


SYMPTOM - NO RASTER OR HV - SOUND DISTORTED
SCOPE; CHECK HORIZONTAL DRIVE AT COLLECTOR OF DRIVER (Q-17) T. P. "F"
DRIVE OK APPROX 160V PP
SCOPE; CHECK DRIVE AT BASE OF Q-18 HORIZONTAL OUTPUT
DRIVE AT BASE Q-18 OK
HORIZ OUTPUT STAGE DEFECTIVE
CHECK Q-18, DC VOLTAGE PATHS
NO DRIVE AT BASE OF Q-18
REMOVE BASE LEAD AND RECHECK AT LEAD
DRIVE OK NOW
Q-18 LIKELY SHORTED
NO DRIVE AT BASE LEAD
T-500 DEFECTIVE
DRIVE LOW LESS THAN 140V
REMOVE Q-18 AND RECHECK
DRIVE RETURNS TO NORMAL
OUTPUT STAGE DEFECTIVE
Q-18 LIKELY SHORTED EMITTER TO BASE. CHECK COLLECTOR VOLTAGE. (CHECK T-500)
NO HORIZONTAL DRIVE AT T. P. "F"
PREVIOUS STAGES DEFECTIVE
SCOPE; CHECK OSCILLATOR OUTPUT AT COLLECTOR OF Q-15
OSCILLATOR OUTPUT OK
SCOPE, CHECK: SHAPER (Q-16) OUTPUT AT COLLECTOR
OUTPUT OF SHAPER OK
DRIVER STAGE DEFECTIVE
VTVM CHECK: EMITTER BASE AND COLLECTOR VOLTAGES. CHECK Q-17
SC-2905-B
NO OSCILLATOR OUTPUT
Q-15 CIRCUIT DEFECTIVE
CHECK Q-15 (GROUND T. P. "E" TO ELIMINATE AFC) VTVM CHECK EMITTER, BASE AND COLLECTOR VOLTAGES
NO OUTPUT
SHAPER STAGE DEFECTIVE
CHECK Q-16. VTVM, CHECK EMITTER, BASE AND COLLECTOR VOLTAGES

NOTE: DUE TO DC COUPLING BETWEEN Q-15, Q-16 AND Q-17, A DEFECTIVE STAGE WILL CAUSE VOLTAGES IN FOLLOWING STAGES TO CHANGE.

FIGURE 75 - HORIZONTAL SWEEP DEFECTIVE

FIGURE 74 - NO RASTER

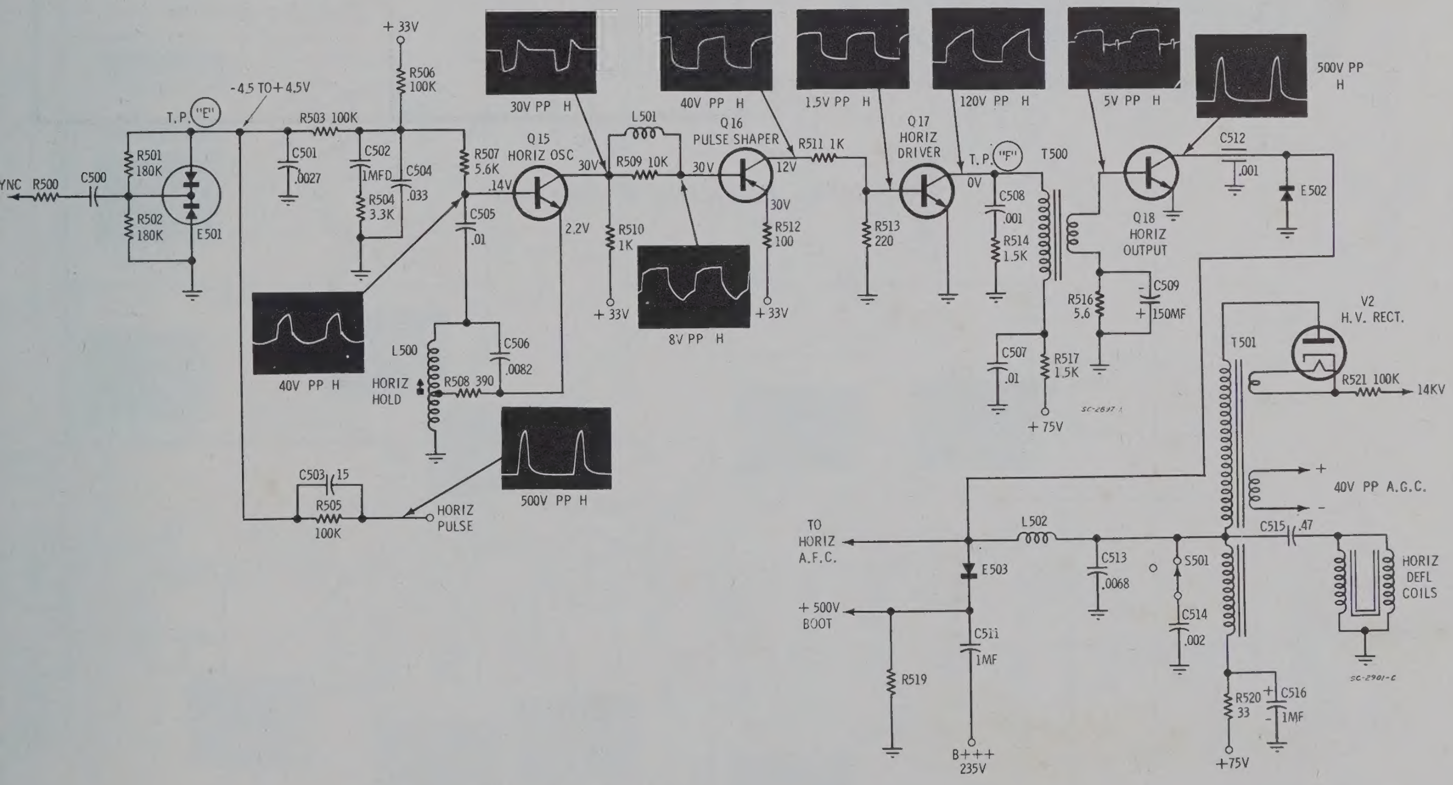
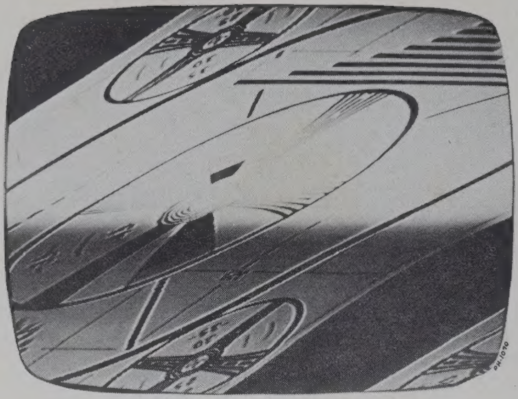
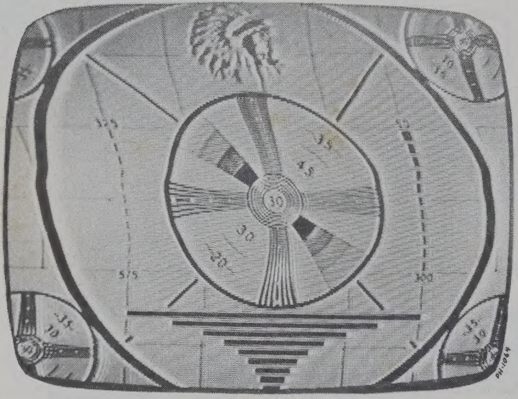

+ 33V
R506 100K
-4.5 TO +4.5V
T.P. "E"
R503 100K
R501 180K
R502 180K
E501
YNC R500
C500
C501 .0027
C502 1MFD
C504 .033
R504 3.3K
R507 5.6K
.14V
C505 .01
Q15 HORIZ OSC
30V
2.2V
40V PP H
L500
HORIZ HOLD
R508 390
C506 .0082
C503 15
R505 100K
HORIZ PULSE
500V PP H
30V PP H
L501
R509 10K
R510 1K
+ 33V
8V PP H
40V PP H
Q16 PULSE SHAPER
30V
12V
30V
R512 100
+ 33V
1.5V PP H
R511 1K
R513 220
Q17 HORIZ DRIVER
0V
120V PP H
T.P. "F"
T500
C508 .001
R514 1.5K
C507 .01
R517 1.5K
+ 75V
SC-2897
5V PP H
Q18 HORIZ OUTPUT
R516 5.6
C509 150MF
500V PP H
C512 .001
E502
V2 H.V. RECT.
T501
R521 100K
14KV
40V PP A.G.C.
TO HORIZ A.F.C.
L502
E503
C513 .0068
S501
C514 .002
C515 .47
HORIZ DEFL COILS
+ 500V BOOT
R519
C511 1MF
B+++ 235V
R520 33
C516 1MF
+75V
SC-2901-C

FIGURE 76 - TROUBLESHOOTING HORIZONTAL SWEEP CIRCUITS



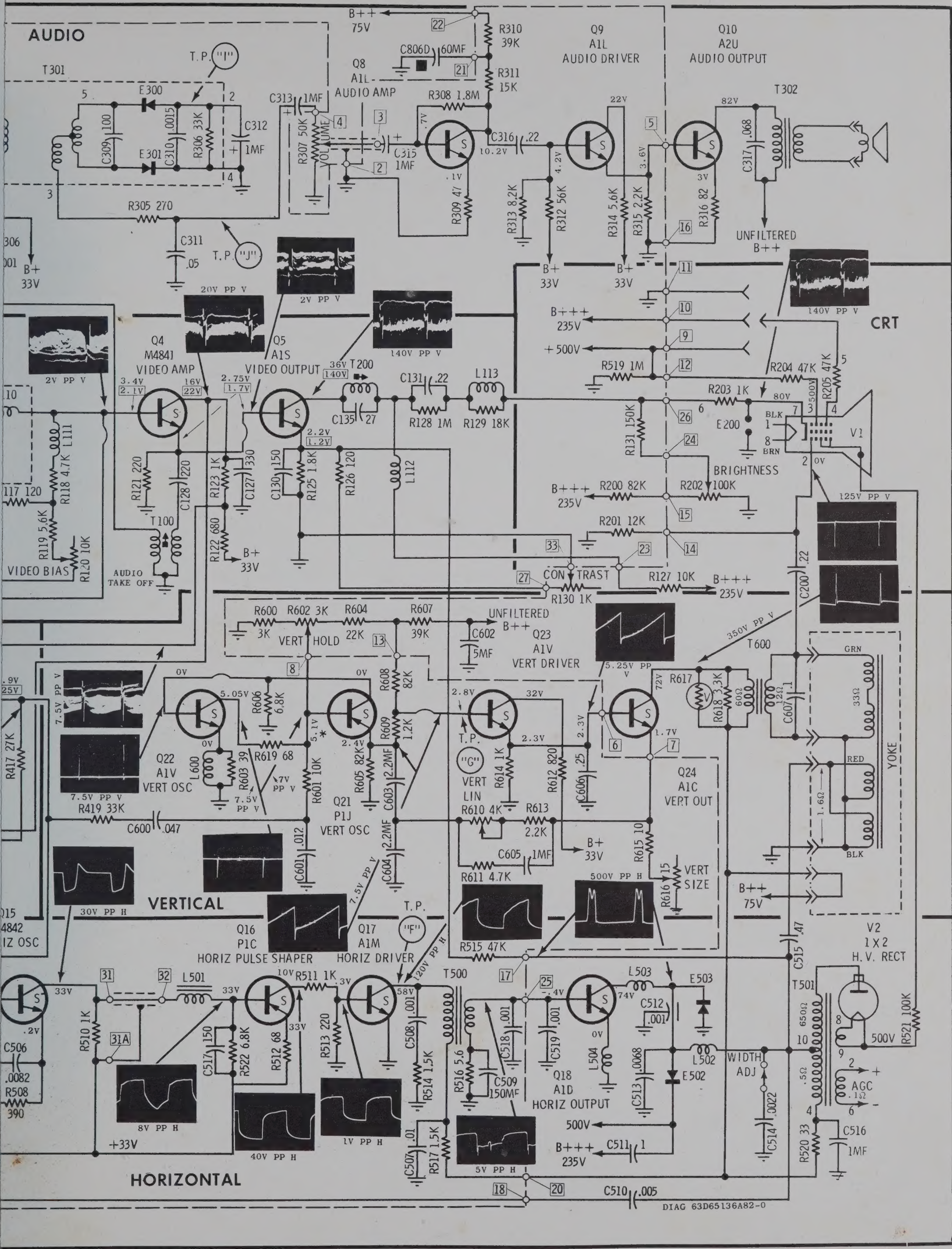
NO HORIZONTAL SYNC	
PROBABLE CIRCUITS	TYPICAL COMPONENTS
HORIZONTAL OSCILLATOR	R-507, C-505, C-506
HORIZONTAL AFC	E-501, R-500, R-503, R-504, R-505, C-500, C-501, C-502, C-503, C-504

FIGURE 77 - NO HORIZONTAL SYNC

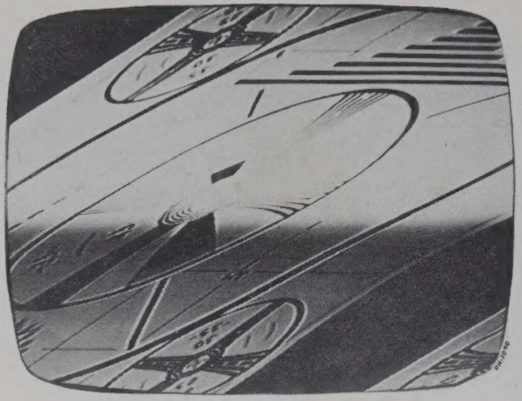


HORIZONTAL PULLING	
PROBABLE CIRCUITS	TYPICAL COMPONENTS
HORIZONTAL AFC	E-501, R-500, R-503, R-504, R-505, C-500, C-501, C-502, C-503, C-504

FIGURE 78 - HORIZONTAL PULLING

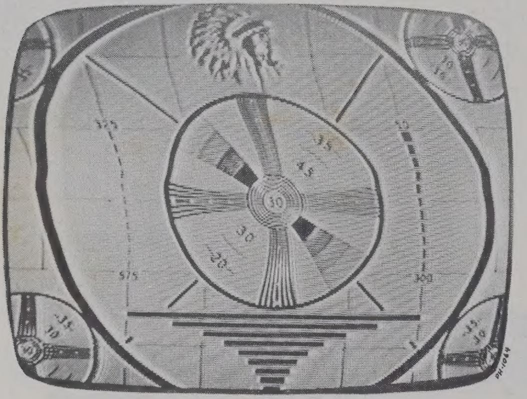

AUDIO
T301
T.P. "I"
5
E300
2
C309 100
C310 .0015
R306 33K
C312 1MF
E301
4
3
R305 270
306
001
B+ 33V
C311 .05
T.P. "J"
B++ 75V
22
R310 39K
C806D 60MF
21
R311 15K
Q8 A1L AUDIO AMP
C313 1MF
R307 50K VOLUME
4
3
2
C315 1MF
R308 1.8M
.7V
.1V
R309 47
C316 .22
10.2V
Q9 A1L AUDIO DRIVER
22V
4.2V
R313 8.2K
R312 56K
R314 5.6K
R315 2.2K
5
3.6V
Q10 A2U AUDIO OUTPUT
82V
T302
C317 .068
3V
R316 82
16
UNFILTERED B++
B+ 33V
B+ 33V
11
10
B+++ 235V
9
+500V
R519 1M
12
CRT
140V PP V
20V PP V
2V PP V
140V PP V
2V PP V
Q4 M4841 VIDEO AMP
Q5 A1S VIDEO OUTPUT
3.4V
2.1V
16V
22V
2.75V
1.7V
36V
140V
T200
C131 .22
L113
C135 27
R128 1M
R129 18K
110
L111
R118 4.7K
117 120
R119 5.6K
R120 10K VIDEO BIAS
R121 220
C128 220
R123 1K
C127 330
T100
AUDIO TAKE OFF
R122 680
B+ 33V
2.2V
1.2V
C130 150
R125 1.8K
R126 120
L112
R204 47K
R205 47K
5
R203 1K
80V
500V
26
6
E200
7
3
4
BLK 1
8 BRN
V1
R131 150K
24
2
0V
BRIGHTNESS
B+++ 235V
R200 82K
R202 100K
15
R201 12K
14
33
23
27
CONTRAST
R130 1K
R127 10K
B+++ 235V
125V PP V
C200 .22
350V PP V
R600 3K
R602 3K VERT HOLD
R604 22K
R607 39K
UNFILTERED B++
C602 5MF
Q23 A1V VERT DRIVER
5.25V PP V
13
8
R608 82K
T600
72V
R617
R618 3.3K
60Ω
12Ω
C607 .1
33Ω
GRN
.9V
25V
7.5V PP V
0V
5.05V
R606 6.8K
0V
5.1V
2.4V
R609 1.2K
2.8V
32V
2.3V
2.3V
6
1.7V
7
R417 27K
0V
L600
R603 39
R619 68
7V PP V
7.5V PP V
Q22 A1V VERT OSC
7.5V PP V
R601 10K
R605 82K
C603 2.2MF
Q21 P1J VERT OSC
T.P. "G"
VERT LIN
R614 1K
R612 820
C606 .25
Q24 A1C VERT OUT
RED
YOKE
1.6Ω
R419 33K
C600 .047
C601 .012
C604 2.2MF
R610 4K
R613 2.2K
B+ 33V
R615 10
C605 1MF
R611 4.7K
R616 15 VERT SIZE
BLK
B++ 75V
500V PP H
30V PP H
VERTICAL
7.5V PP V
Q15 4842 IZ OSC
Q16 P1C HORIZ PULSE SHAPER
T.P. "F"
Q17 A1M HORIZ DRIVER
120V PP H
R515 47K
17
C515 .47
V2 1X2 H.V. RECT
33V
31
32
L501
33V
10V
R511 1K
.3V
58V
T500
25
-.4V
L503
E503
T501
.2V
R510 1K
31A
C506 .0082
R508 390
C517 150
R522 6.8K
R512 68
33V
R513 220
C508 .001
R514 1.5K
R516 5.6
C509 150MF
C518 .001
C519 .001
74V
0V
L504
C512 .001
C513 .0068
L502
E502
WIDTH ADJ
C514 .0022
650Ω
10
8
500V
R521 100K
9
2
AGC .1Ω
6
.5Ω
4
R520 33
C516 1MF
8V PP H
40V PP H
1V PP H
Q18 A1D HORIZ OUTPUT
500V
5V PP H
B+++ 235V
C511 1
+33V
C507 .01
R517 1.5K
18
20
C510 .005
HORIZONTAL
DIAG 63D65136A82-0

EMATIC DIAGRAM



NO HORIZONTAL SYNC	
PROBABLE CIRCUITS	TYPICAL COMPONENTS
HORIZONTAL OSCILLATOR	R-507, C-505, C-506
HORIZONTAL AFC	E-501, R-500, R-503, R-504, R-505, C-500, C-501, C-502, C-503, C-504

FIGURE 77 - NO HORIZONTAL SYNC



HORIZONTAL PULLING	
PROBABLE CIRCUITS	TYPICAL COMPONENTS
HORIZONTAL AFC	E-501, R-500, R-503, R-504, R-505, C-500, C-501, C-502, C-503, C-504

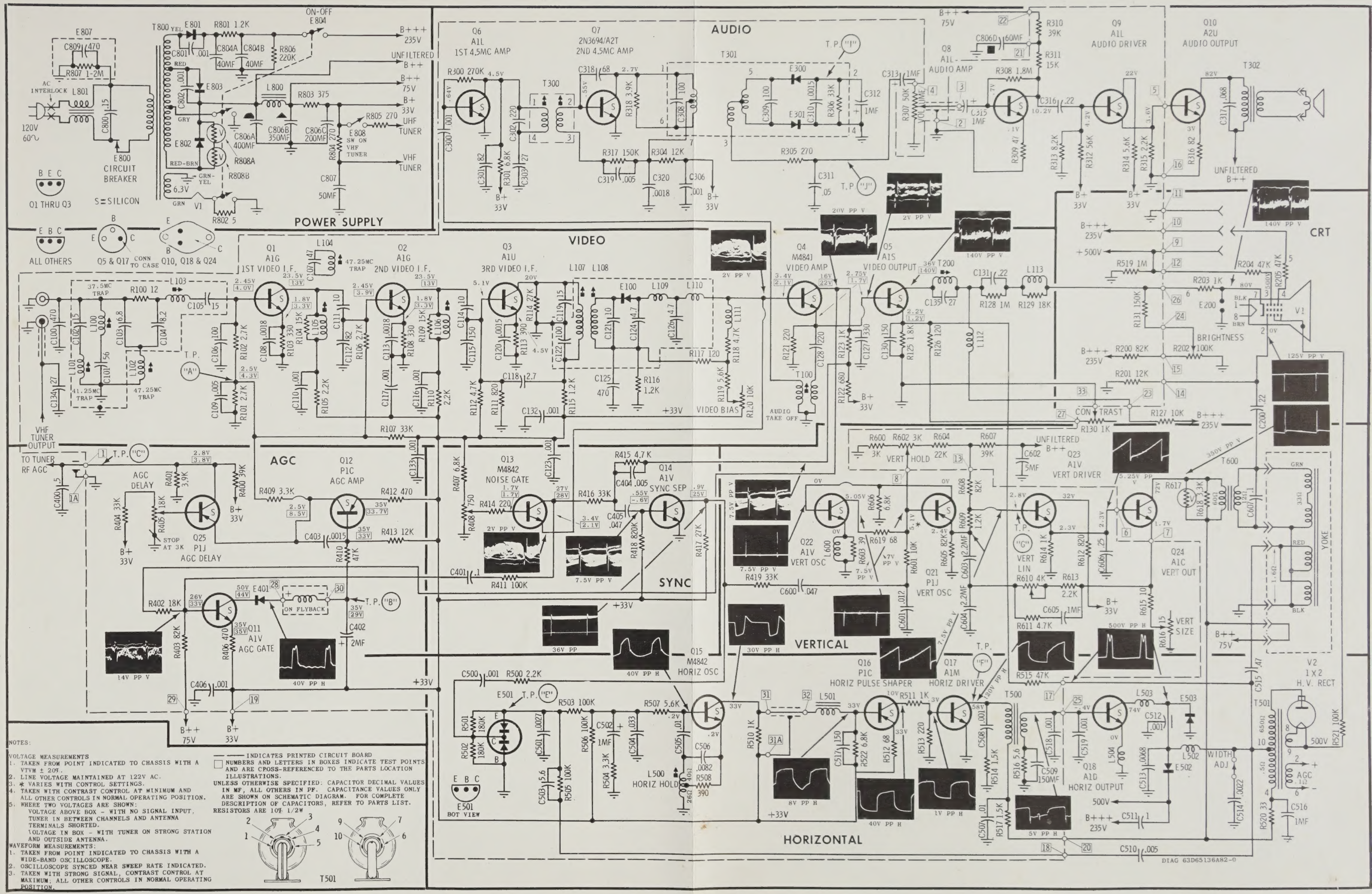
FIGURE 78 - HORIZONTAL PULLING

FUNCTION, TYPE & MOTOROLA NO.	MAXIMUM PWR DISS. (NOTE 9)	BV_{CEO}	H_{FE} (BETA - NOTE 12)	f_T
Vertical Output Silicon NPN 4900/A1C	100w @ 60°C	See Note 10	30-90 @ V_{CE} 5V I_C 300ma (See Note 11)	
Horiz. Output Silicon NPN 4901/A1D	Special application, use exact Motorola replacement type only.			
Video I.F. (Forward AGC) Silicon NPN 4904/A1G (Note #1)	210mw @ 60°C	40V @ I_C 2ma	40 min @ V_{CE} 10V I_C 4ma	45MC pwr gain 25 db min
4.5MC amp Audio amp Silicon NPN 4918/A1L	210mw @ 60°C	40V @ I_C 1ma	100 min @ V_{CE} 10V I_C 1ma	
Horiz. Driver Silicon NPN 4919/A1M	1.2w @ 60°C	140V @ I_C 1ma	10 min @ V_{CE} .3V I_C 150ma	100MC min @ V_{CE} 20V I_C 20ma
Audio Output Silicon NPN 4920/A1N	7.5w @ 100°C	350V @ I_C 1ma	50-250 @ V_{CE} 10V I_C 50ma	15MC min @ V_{CE} 10V I_C 100ma
Video Output Silicon NPN 4927/A1S	.6w @ 60°C	325V @ I_C 1ma	20 min @ V_{CE} 20V I_C 30ma 15 min @ V_{CE} 10V I_C 10ma	50MC min @ V_{CE} 20V I_C 20ma
3rd I.F. Amp Silicon NPN 4932/A1U	210mw @ 60°C	40V @ I_C 1ma	20-100 @ V_{CE} 10V I_C 10ma	45MC pwr gain I_C 10ma 27 db min
AGC Amp, Vert OSC, Hor Pulse Shaper, AGC Delay Silicon PNP 4910/P1C	210mw @ 60°C	-40V @ I_C 1ma	50-200 @ V_{CE} 10V I_C 10ma	
1st Video amp Silicon NPN 4841	210mw @ 60°C	40V @ I_C 1ma	100-300 @ V_{CE} 10V I_C 10ma	200MC min @ V_{CE} 15V I_C 10ma
Noise Gate H. OSC Silicon NPN 4842	210mw @ 60°C	40V @ I_C 1ma	50-200 @ V_{CE} 10V I_C 10ma	
AGC Gate, Sync Sep, V Driver, Vert Pulse Inv. Silicon NPN 4933/A1V	210mw @ 60°C	40V @ I_C 1ma	200-400 @ V_{CE} 10V I_C 10ma	30 min @ V_{CE} 10V I_C 10ma
AFC Diode Silicon 4917/D1C	I_R=100 ua dc @ 60V DC		Trr=1.5 usec	
Damper & Pulse Limiter Diode Silicon 4921/D1D	I_R=10 ua dc @ 700V DC		V_F=1.1V @ 1 amp T_S=2 usec @ I_F=5A	

NOTES:
1. *Special application - Replace with exact Motorola replacement type only.
2. BV_{CEO} - Breakdown voltage, collector to emitter, base open.
3. H_{FE} - dc forward current transfer ratio (common emitter) Beta
4. f_T - Current gain-bandwidth product. Frequency at which beta equals 1.
5. V_F - Forward voltage drop.
6. I_R - Reverse current.
7. T_S - Turn on time.
8. T_{rr} - Recovery time.
9. Power dissipation derating factor:
   210mw @ 60°C units derate 2.8mw per °C rise over 60°C
   .6w @ 60°C units derate 5.3mw per °C rise over 60°C
   1.2w @ 60°C units derate 8.7mw per °C rise over 60°C
   7.5w @ 100°C units derate 100mw per °C rise over 100°C
10. Breakdown voltage (BV_{CER}) is measured with 1500 ohm resistor connected between emitter and base.

    BV_{CER}=500V I_C 2ma
11. Beta @ V_{CE} 5V I_C 400ma must be higher than beta @ V_{CE} 5V I_C 300ma.
12. Beta = ratio of change in collector current to change in base current (or gain of the transistor)

FIGURE 79 - TRANSISTOR SPECIFICATIONS CHART


POWER SUPPLY
AUDIO
VIDEO
AGC
SYNC
VERTICAL
HORIZONTAL
CRT
T800
E807
ON-OFF E804
AC INTERLOCK
120V 60~
E800 CIRCUIT BREAKER
S=SILICON
Q1 THRU Q3
ALL OTHERS
Q5 & Q17
Q10, Q18 & Q24
CONN TO CASE
B+++ 235V
UNFILTERED B++
B++ 75V
B+ 33V
UHF TUNER
VHF TUNER
Q6 A1L 1ST 4.5MC AMP
Q7 2N3694/A2T 2ND 4.5MC AMP
Q8 A1L AUDIO AMP
Q9 A1L AUDIO DRIVER
Q10 A2U AUDIO OUTPUT
T300
T301
T302
Q1 A1G 1ST VIDEO I.F.
Q2 A1G 2ND VIDEO I.F.
Q3 A1U 3RD VIDEO I.F.
Q4 M4841 VIDEO AMP
Q5 A1S VIDEO OUTPUT
VHF TUNER OUTPUT
TO TUNER RF AGC
47.25MC TRAP
41.25MC TRAP
37.5MC TRAP
VIDEO BIAS
AUDIO TAKE OFF
BRIGHTNESS
CONTRAST
V1
Q12 P1C AGC AMP
Q25 P1J AGC DELAY
Q11 A1V AGC GATE
Q13 M4842 NOISE GATE
Q14 A1V SYNC SEP
Q22 A1V VERT OSC
Q21 P1J VERT OSC
Q23 A1V VERT DRIVER
Q24 A1C VERT OUT
VERT HOLD
VERT LIN
VERT SIZE
YOKE
T600
Q15 M4842 HORIZ OSC
Q16 P1C HORIZ PULSE SHAPER
Q17 A1M HORIZ DRIVER
Q18 A1D HORIZ OUTPUT
HORIZ HOLD
T500
T501
WIDTH ADJ
AGC
V2 1X2 H.V. RECT
E501 BOT VIEW
DIAG 63D65136A82-0

NOTES:

VOLTAGE MEASUREMENTS
1. TAKEN FROM POINT INDICATED TO CHASSIS WITH A VTVM ± 20%.
2. LINE VOLTAGE MAINTAINED AT 122V AC.
3. ✱ VARIES WITH CONTROL SETTINGS.
4. TAKEN WITH CONTRAST CONTROL AT MINIMUM AND ALL OTHER CONTROLS IN NORMAL OPERATING POSITION.
5. WHERE TWO VOLTAGES ARE SHOWN:
   VOLTAGE ABOVE BOX - WITH NO SIGNAL INPUT, TUNER IN BETWEEN CHANNELS AND ANTENNA TERMINALS SHORTED.
   VOLTAGE IN BOX - WITH TUNER ON STRONG STATION AND OUTSIDE ANTENNA.

WAVEFORM MEASUREMENTS:
1. TAKEN FROM POINT INDICATED TO CHASSIS WITH A WIDE-BAND OSCILLOSCOPE.
2. OSCILLOSCOPE SYNCED NEAR SWEEP RATE INDICATED.
3. TAKEN WITH STRONG SIGNAL, CONTRAST CONTROL AT MAXIMUM; ALL OTHER CONTROLS IN NORMAL OPERATING POSITION.

— —— INDICATES PRINTED CIRCUIT BOARD

☐ NUMBERS AND LETTERS IN BOXES INDICATE TEST POINTS AND ARE CROSS-REFERENCED TO THE PARTS LOCATION ILLUSTRATIONS.

UNLESS OTHERWISE SPECIFIED: CAPACITOR DECIMAL VALUES IN MF, ALL OTHERS IN PF. CAPACITANCE VALUES ONLY ARE SHOWN ON SCHEMATIC DIAGRAM. FOR COMPLETE DESCRIPTION OF CAPACITORS, REFER TO PARTS LIST.

RESISTORS ARE 10% 1/2W

FIGURE 80 - SCHEMATIC DIAGRAM

television **MANUAL 68P65135A88**

CHASSIS 12TS-458

MODEL XP303C

MOTOROLA service manual

GENERAL INFORMATION

This receiver uses a transistorized chassis designed for AC line operation. All circuits are solid state except for the high voltage rectifier and CRT.

The chassis is of compact construction and uses an etched board on which is mounted the major portion of the circuitry. Sweep and audio circuits are mounted external to the board on metal chassis brackets for better heat dissipation. A circuit legend and test points on the board facilitate troubleshooting.

The CRT heater is operated at a reduced voltage when the on/off switch is in the off position. This reduces the warm-up time, keeping the receiver ready to operate when turned on.

The transistor complement consists of 23 transistors on the chassis plus three in the VHF tuner and one in the UHF tuner. The chassis uses 13 diodes and one high voltage rectifier plus the CRT.

ELECTRICAL SPECIFICATIONS

Power Rating: 60 watts

Source: 120 volts, 60 cycle AC

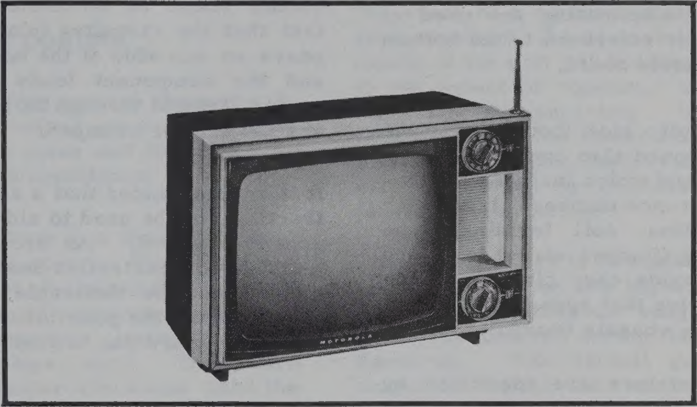
INTERMEDIATE FREQUENCIES

I.F. . . . . Video 45.75Mc
Sound 41.25Mc

Sound I.F. 4.5Mc

CAUTION

NO WORK SHOULD BE ATTEMPTED ON AN EXPOSED TELEVISION CHASSIS BY ANYONE NOT FAMILIAR WITH SERVICING PROCEDURES AND PRECAUTIONS.



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MODEL BREAKDOWN CHART

MODEL	CHASSIS	VHF TUNER	UHF TUNER	CRT
XP303CW	12TS-458	SCPTT-394	KTT-622 or KTT-626	12CGP4

television MANUAL 68P65135A88
CHASSIS 12TS-458
MODEL XP303C

MOTOROLA INC. 9401 WEST GRAND AVENUE, FRANKLIN PARK, ILLINOIS

PART NO. 68P65135A88 4-67 PRICE 65 CENTS

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SERVICE NOTES

ETCHED BOARD CIRCUIT TRACING

The top (component side) of the chassis board contains a complete legend of the chassis circuit that appears on the bottom and identification of all components by reference numbers that are related to the reference numbers on the schematic diagram. The circuit may be traced from the top of the chassis board and all components can be identified eliminating the need of making any reference to the bottom of the chassis board.

The circuit side (bottom) of the chassis board also contains a complete legend which includes component reference numbers, transistor identification, coil terminals and the wiring (jumper wires) is traced in to provide easy circuit tracing of the wiring that appears on the top side of the chassis board.

The transistors are identified by their function as well as the reference number. The transistor elements are identified as follows: E - emitter, B - base and C- collector.

The tracing indicates where the wiring (jumper wires) on the top of the chassis board is connected.

Breaks appear in the wire tracing to facilitate the identification of components location. Each wire trace begins and ends with an arrow to indicate where it begins and ends.

To further facilitate circuit tracing of the etched chassis board, a photograph of the chassis board with the pertinent test points identified and related to the schematic diagram is included in this manual.

The test points on the schematic diagram are identified descriptively and/or by numbers and are blocked in or circled for easy identification. These test points are also shown on the chassis board photographs and serve to pinpoint the physical location of the electrical junction or test point of interest.

All other test points may be easily located by circuit tracing from a transistor, coil, etc. or any point that is readily identified.

CHASSIS REMOVAL

Seven (7) screws secure the chassis to the cabinet. They are located as follows: three (3) on the tuner mounting bracket, one (1) at the upper right hand corner and three (3) on the bottom of the cabinet.

Removing components from the etched board is facilitated by the fact that the circuitry (plating) appears on one side of the board only and the component leads are inserted straight through the holes and are not bent or crimped.

It is recommended that a solder extracting gun be used to aid in component removal. An iron with a temperature controlled heating element would be desirable since it would reduce the possibility of damaging the board due to over-heating.

The nozzle of the soldering gun is inserted directly over the component lead and when sufficiently heated, the solder is drawn away leaving the lead free from the copper plating. This method is particularly suitable in removing multi-terminal components.

COIL SHIELD REMOVAL

The shields on the IF input assembly (L-100, L-101, L-102 and L-103), the video detector transformer (L-107 and L-108) and the ratio detector transformer (T-301) are mounted to the board with spring clips for ease of removal. The shields may be removed by carefully rocking the shield while pulling upward. It may be necessary to pry up shield slightly to start it. Avoid excessive bending of the plated board while removing shield.

PICTURE TUBE REPLACEMENT

Use extreme care in handling the picture tube as rough handling may cause it to implode due to atmospheric pressure. Do not nick or scratch glass or subject it to any undue pressure in removal or installation. Use goggles and heavy gloves for protection.

CRT REMOVAL

CRT is removed from the rear of cabinet.

To remove picture tube, remove chassis as previously described, then remove corner screws securing picture tube to cabinet.

ADJUSTMENTS

FINE TUNING ADJUSTMENT

Rotate the fine tuning knob in either direction for best picture and sound on all available channels. Turning the fine tuning shaft to the right or left engages the pre-set gears. The gears, in turn, change the position of the core in the oscillator coil. Individual coils are used for each channel. Therefore, channel preset adjustments can be made in any sequence.

FOCUSING ADJUSTMENT

To provide for differences in the picture tube gun structure, a focus adjustment is provided by three (3) lugs located on the chassis. They provide a ground potential point, a B+++ voltage point and a bootstrap voltage point. Connect the blue lead from the picture tube socket to the lug which provides the best over-all focus, center to edge of screen. See top chassis view for lug location.

VIDEO BIAS ADJUSTMENT

The bias on the 1st video amplifier is adjusted for the no-signal condition. Proceed as follows:

1. Disable 3rd IF amplifier, Q-3, by shorting base and emitter together.

2. Set contrast control, R-130, full clockwise (maximum contrast).

3. Measure 2nd video amplifier, Q-5, collector voltage and adjust video bias control for 23V DC on the collector. Line voltage should be set a 122 volts when adjustment is made.

RF AGC DELAY CONTROL ADJUSTMENT

Adjustable RF AGC delay is incorporated to provide the best possible signal to noise ratio and freedom from overload. The purpose of delaying the RF AGC (which reduces tuner gain) is to operate the tuner RF stage at high gain until its signal output is greater than mixer noise. The control is adjusted as follows:

1. Set RF AGC control maximum clockwise position (minimin AGC).

2. Tune in a signal that will produce 3.5 to 4 volts at T.P. "A" (IF AGC buss).

3. Adjust RF AGC control for 3 volts at T.P. "C" (RF AGC).

4. Check T.P. "C" for 2.5 volts between channels and no overload visible at the CRT on strongest channels.

An alternate method of adjusting the RF AGC delay control is by viewing the picture. Tune in the strongest channel available. Adjust the control and note its effect on the picture. In one range of control setting, the picture will have noise or a busy background and as the control is rotated, the picture will clear up. Further rotation of the control will cause overload on strong signals as evidenced by loss of interlace. Set the control midway between the point at which the noise disappears and the overload point.

NOTE: Holes have been provided in the cabinet bottom to allow adjustment of the video bias and RF AGC without removing cabinet back.

NOISE GATE CONTROL

The noise gate control is used to adjust the receiver for best hold stability under noise and different signal strength conditions.

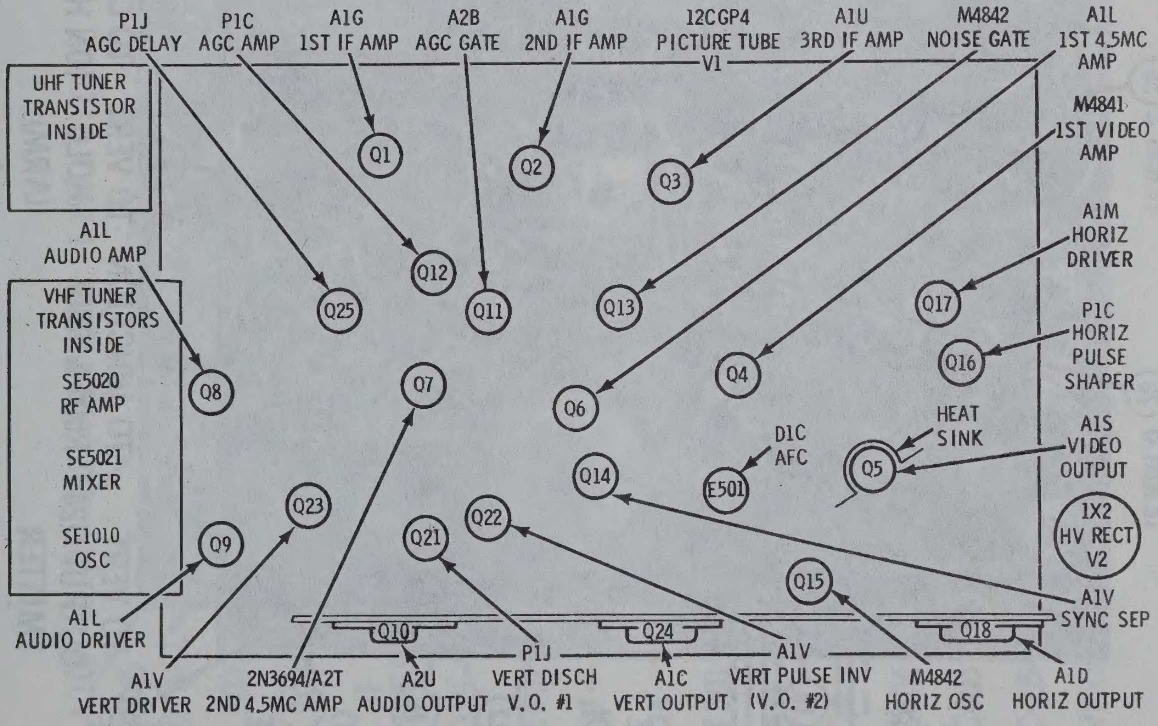
To adjust, tune in a channel for best picture and sound. Turn the noise gate control clockwise (when viewed from rear of receiver) until the picture becomes unstable (rolls down or slips, etc.). Then, turn control counter-clockwise until the picture returns to normal. Check all channels; if any are unstable, continue turning control counter-clockwise until the picture is normal on all channels.

CIRCUIT GUARD

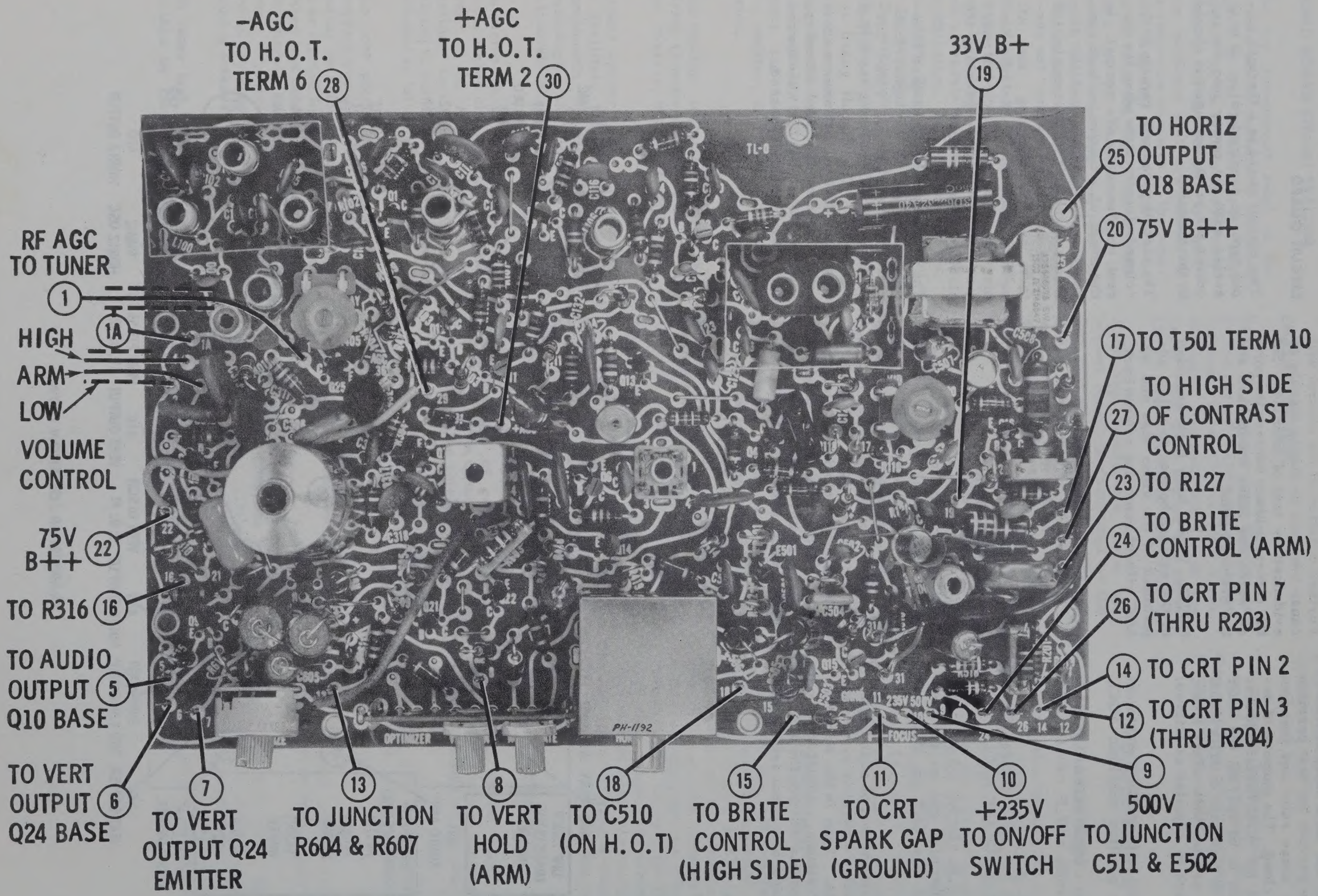
The circuit guard is a thermal cut-out type of overload relay. It is in series with the power into the receiver for protection against shorts in the chassis.

The circuit guard will remain in the "closed circuit" state when the current requirements are normal. In the event of a continuous high current overload, the bi-metallic elements of the unit will become heated to the extent of "opening" the contacts and disconnecting the AC power. After the bi-metallic elements have cooled, the circuit guard may be re-set by depressing the plastic re-set button.

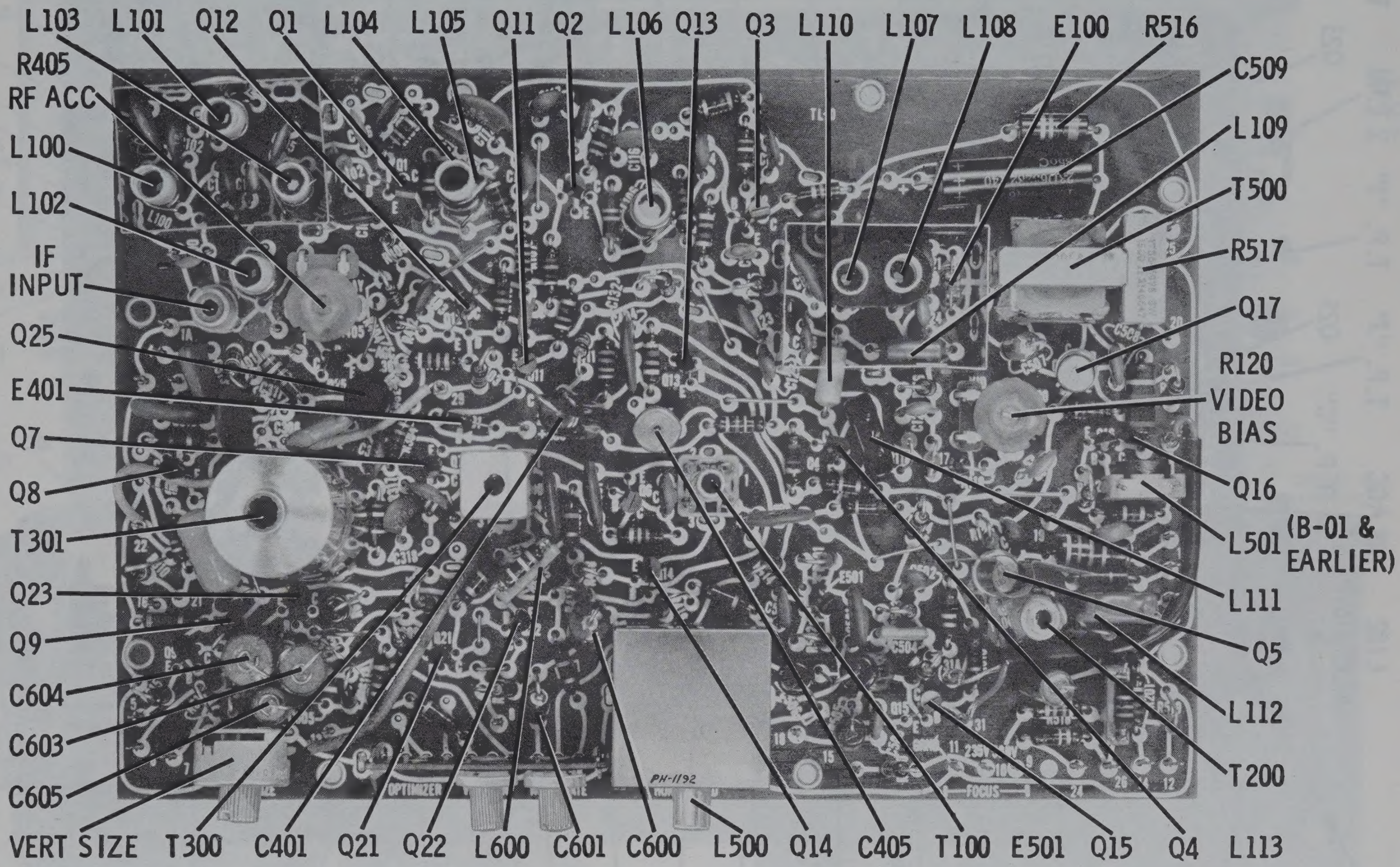
The circuit guard is designed to remain "closed" on the higher-than-normal instantaneous surge currents encountered during the initial warm-up. The circuit guard is unique in the fact that when a short exists in the associated circuitry, power is not re-applied when the re-set button is held depressed.


P1J AGC DELAY
P1C AGC AMP
A1G 1ST IF AMP
A2B AGC GATE
A1G 2ND IF AMP
12CGP4 PICTURE TUBE V1
A1U 3RD IF AMP
M4842 NOISE GATE
A1L 1ST 4.5MC AMP
UHF TUNER TRANSISTOR INSIDE
M4841 1ST VIDEO AMP
Q1
Q2
Q3
A1L AUDIO AMP
A1M HORIZ DRIVER
Q12
VHF TUNER TRANSISTORS INSIDE
Q25
Q11
Q13
Q17
SE5020 RF AMP
Q8
P1C HORIZ PULSE SHAPER
Q16
Q7
Q4
Q6
SE5021 MIXER
HEAT SINK
D1C AFC
A1S VIDEO OUTPUT
Q14
E501
Q5
Q23
SE1010 OSC
1X2 HV RECT V2
Q22
Q21
Q9
Q15
A1L AUDIO DRIVER
A1V SYNC SEP
Q10
Q24
Q18
P1J
A1V
A1V VERT DRIVER
2N3694/A2T 2ND 4.5MC AMP
A2U AUDIO OUTPUT
VERT DISCH V.O. #1
A1C VERT OUTPUT
VERT PULSE INV (V.O. #2)
M4842 HORIZ OSC
A1D HORIZ OUTPUT

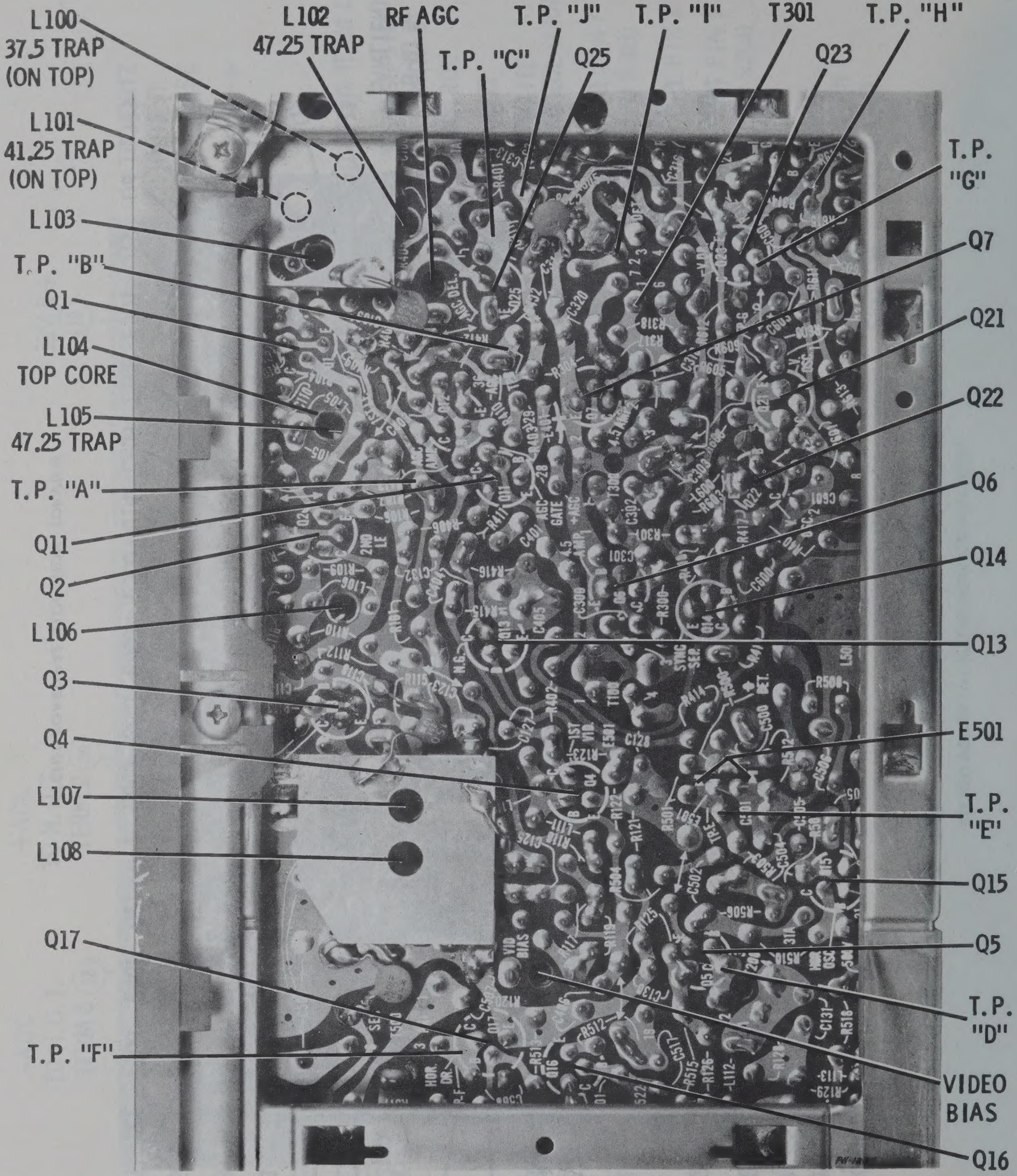
TRANSISTOR LOCATION DETAIL


-AGC
TO H.O.T.
TERM 6 ㉘
+AGC
TO H.O.T.
TERM 2 ㉚
33V B+
⑲
TO HORIZ
㉕ OUTPUT
Q18 BASE
⑳ 75V B++
RF AGC
TO TUNER
①
HIGH
①A
ARM
LOW
VOLUME
CONTROL
⑰ TO T501 TERM 10
TO HIGH SIDE
㉗ OF CONTRAST
CONTROL
㉓ TO R127
TO BRITE
㉔ CONTROL (ARM)
75V
B++ ㉒
TO R316 ⑯
TO CRT PIN 7
㉖ (THRU R203)
TO AUDIO
OUTPUT ⑤
Q10 BASE
⑭ TO CRT PIN 2
TO CRT PIN 3
⑫ (THRU R204)
TO VERT
OUTPUT ⑥
Q24 BASE
⑦
TO VERT
OUTPUT Q24
EMITTER
⑬
TO JUNCTION
R604 & R607
⑧
TO VERT
HOLD
(ARM)
⑱
TO C510
(ON H.O.T)
⑮
TO BRITE
CONTROL
(HIGH SIDE)
⑪
TO CRT
SPARK GAP
(GROUND)
⑩
+235V
TO ON/OFF
SWITCH
⑨
500V
TO JUNCTION
C511 & E502

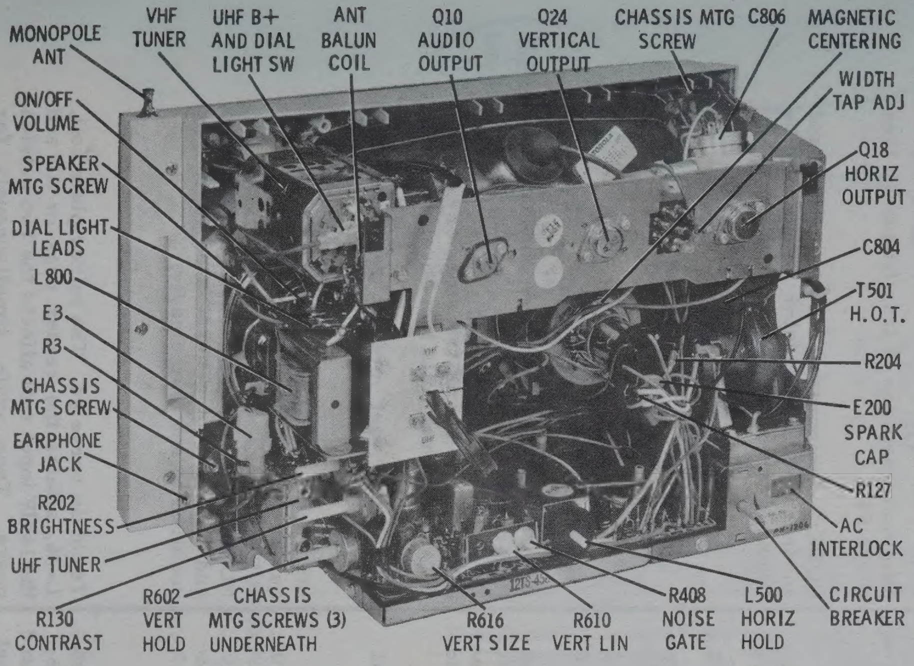
ETCHED BOARD TO CHASSIS INTER-CONNECTIONS


L103
L101
Q12
Q1
L104
L105
Q11
Q2
L106
Q13
Q3
L110
L107
L108
E100
R516
C509
L109
T500
R517
Q17
R120
VIDEO
BIAS
Q16
L501 (B-01 & EARLIER)
L111
Q5
L112
T200
L113
Q4
Q15
E501
T100
C405
Q14
L500
C600
C601
L600
Q22
Q21
C401
T300
VERT SIZE
C605
C603
C604
Q9
Q23
T301
Q8
Q7
E401
Q25
IF INPUT
L102
L100
R405
RF ACC
PH-1192
OPTIMIZER
FOCUS

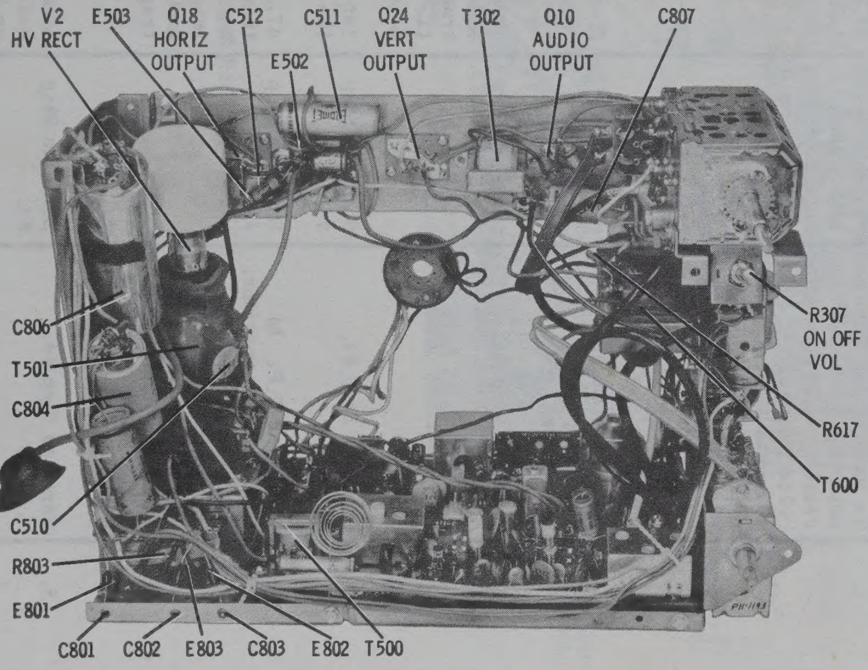
ETCHED BOARD PARTS LOCATION - TOP VIEW


L100 37.5 TRAP (ON TOP)
L102 47.25 TRAP
RF AGC
T.P. "C"
T.P. "J"
Q25
T.P. "I"
T301
Q23
T.P. "H"
L101 41.25 TRAP (ON TOP)
L103
T.P. "B"
Q1
L104 TOP CORE
L105 47.25 TRAP
T.P. "A"
Q11
Q2
L106
Q3
Q4
L107
L108
Q17
T.P. "F"
T.P. "G"
Q7
Q21
Q22
Q6
Q14
Q13
E501
T.P. "E"
Q15
Q5
T.P. "D"
VIDEO BIAS
Q16

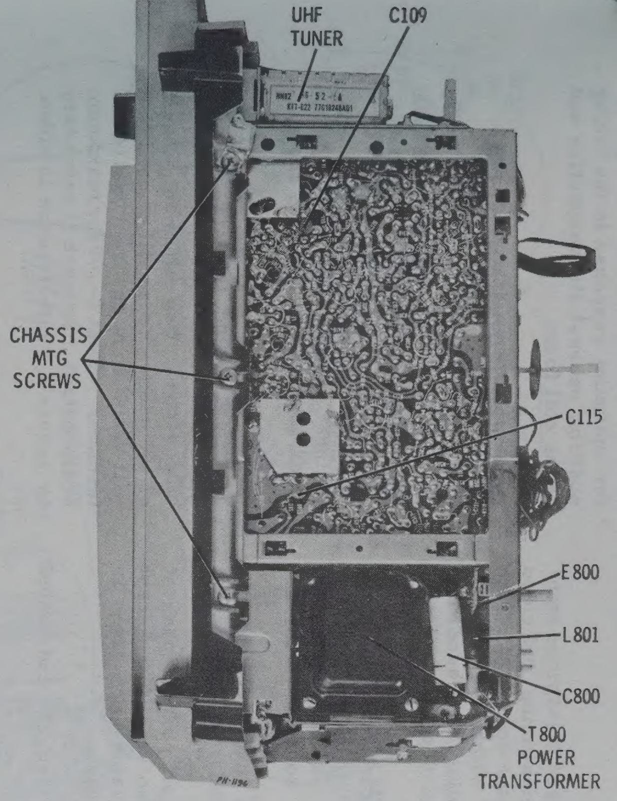
ETCHED BOARD PARTS LOCATION AND TEST POINTS - BOTTOM VIEW


MONOPOLE ANT
VHF TUNER
UHF B+ AND DIAL LIGHT SW
ANT BALUN COIL
Q10 AUDIO OUTPUT
Q24 VERTICAL OUTPUT
CHASSIS MTG SCREW
C806
MAGNETIC CENTERING
WIDTH TAP ADJ
Q18 HORIZ OUTPUT
C804
T501 H.O.T.
R204
E200 SPARK CAP
R127
AC INTERLOCK
CIRCUIT BREAKER
ON/OFF VOLUME
SPEAKER MTG SCREW
DIAL LIGHT LEADS
L800
E3
R3
CHASSIS MTG SCREW
EARPHONE JACK
R202 BRIGHTNESS
UHF TUNER
R130 CONTRAST
R602 VERT HOLD
CHASSIS MTG SCREWS (3) UNDERNEATH
R616 VERT SIZE
R610 VERT LIN
R408 NOISE GATE
L500 HORIZ HOLD

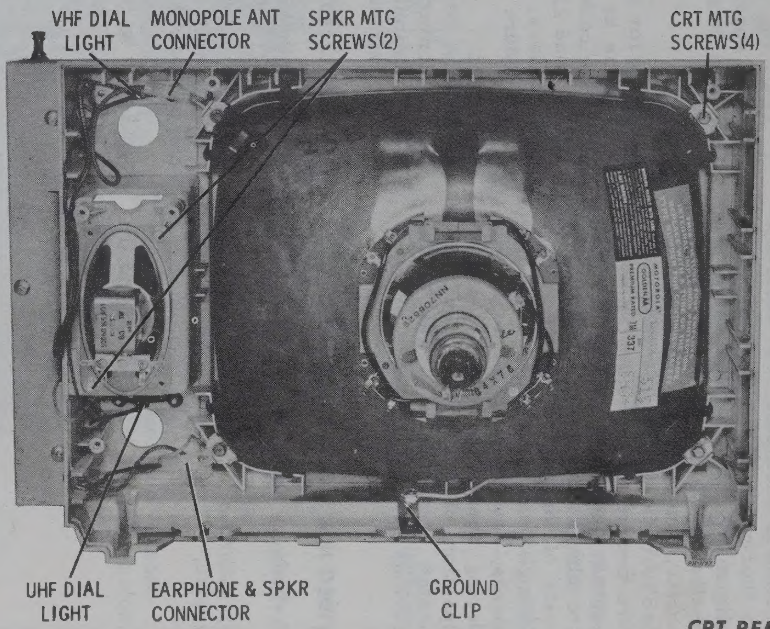
CHASSIS PARTS LOCATION - REAR VIEW


V2 HV RECT
E503
Q18 HORIZ OUTPUT
C512
C511
E502
Q24 VERT OUTPUT
T302
Q10 AUDIO OUTPUT
C807
R307 ON OFF VOL
R617
T600
C806
T501
C804
C510
R803
E801
C801
C802
E803
C803
E802
T500

CHASSIS PARTS LOCATION - FRONT VIEW


UHF TUNER
C109
CHASSIS MTG SCREWS
C115
E800
L801
C800
T800 POWER TRANSFORMER

CHASSIS PARTS LOCATION - BOTTOM VIEW


VHF DIAL LIGHT
MONOPOLE ANT CONNECTOR
SPKR MTG SCREWS(2)
CRT MTG SCREWS(4)
UHF DIAL LIGHT
EARPHONE & SPKR CONNECTOR
GROUND CLIP

CRT REMOVAL

CHASSIS ALIGNMENT

PRE-ALIGNMENT INSTRUCTIONS

Before alignment of the video IF section is attempted, it is advisable to thoroughly check the system. If alignment is attempted on an IF section in which a faulty component exists, successful alignment will probably be impossible and the entire procedure will have to be repeated when the real cause of the trouble is corrected. Preliminary tests of the system should include voltage and resistance measurements, routine checks for bad soldering connections and visual inspection of the circuits for overheated components as well as for obvious wiring defects.

VIDEO IF & MIXER ALIGNMENT

Preliminary Steps

1. Maintain line voltage at 120 with variac.

2. Disable horizontal oscillator by unplugging yoke leads.

3. Disable local oscillator by setting tuner between channels.

4. Apply the positive lead of a 4.5 volt bias supply to IF AGC (T.P. "A") buss and negative lead to chassis ground.

5. Check for correct 1st video amplifier bias by measuring 2nd video amplifier collector voltage. Voltage should read 23V with no signal input. If necessary, adjust bias according to procedure in "Service Notes".

6. Set the contrast and brightness control at maximum (extreme clockwise position). Set noise gate control maximum counter-clockwise.

7. Short across tuner input terminals.

8. Maintain 1 volt peak to peak at the base of video amplifier except when specific values are given in the procedure chart.

9. Refer to "Video IF and Sound Alignment" detail for component and test point locations.

NOTE: To reduce the possibility of inter-action between the two tuning cores in a double-tuned transformer or coil, each core should be adjusted for optimum response in the tuning position nearest its respective end of the coil form.

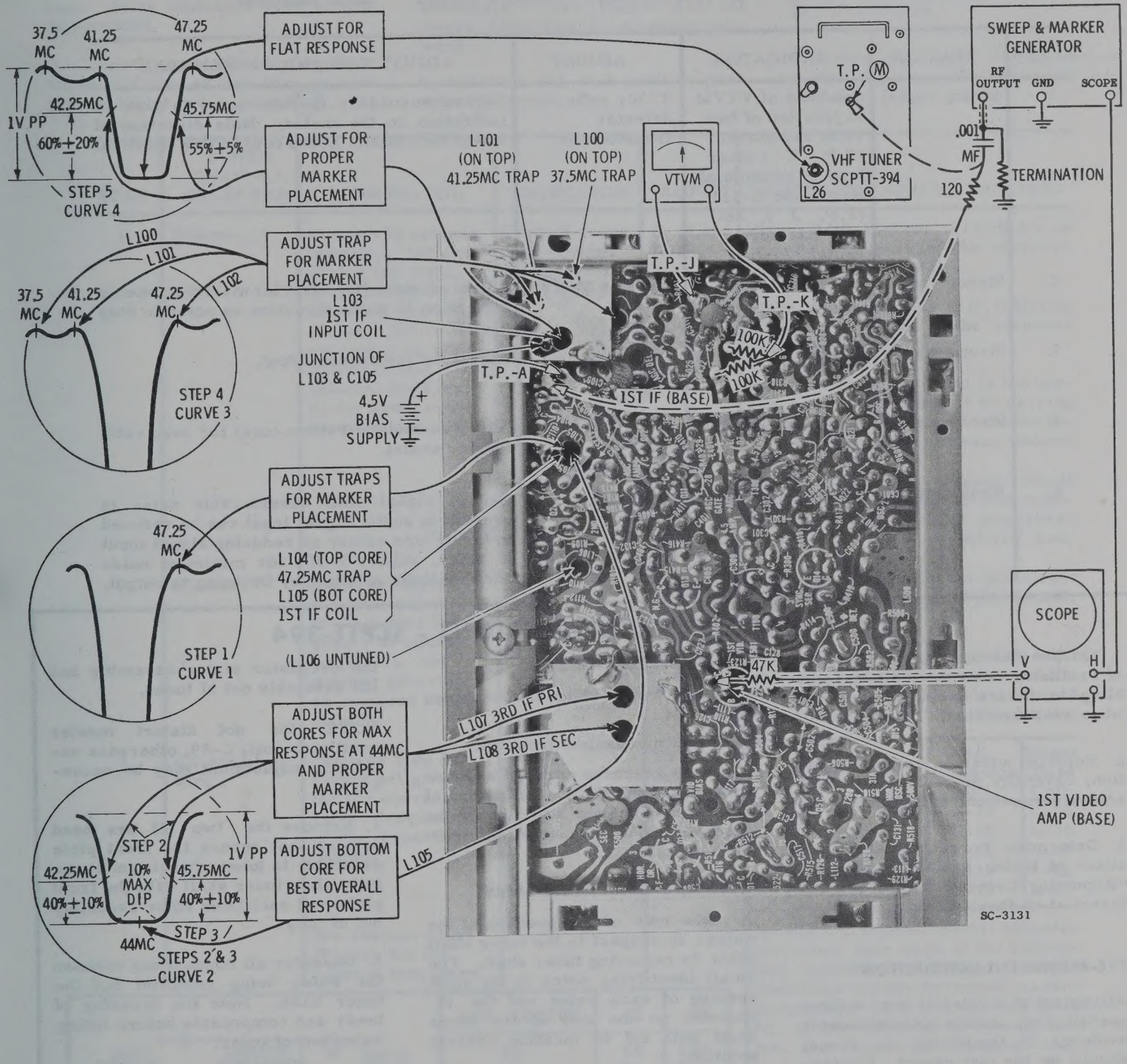
4.5MC TRAP ADJUSTMENT (T-100 and T-200)

1. Carefully tune receiver to local station and advance contrast control.

2. Adjust local oscillator (with fine tuning control) to bring 4.5Mc interference strongly into the picture.

3. Adjust sound trap (T-200) for minimum sound beat on the picture tube screen. Use minimum amount of inductance (core out of coil) that will result in no apparent beat interference. Adjust T-100 for maximum audio output. Retouch if necessary to reduce 4.5 interference in video.

STEP	SWEEP GENERATOR AND MARKER	INDICATOR	ADJUST	ADJUST FOR AND/OR REMARKS
1.	To base of 1st IF amplifier thru 120 ohm resistor in series with .001mf capacitor. Set sweep to 44Mc, markers as required. By-pass junction of L-103 and C-105 to ground thru a .001mf capacitor. NOTE: Generator must be properly terminated.	Scope to base of 1st video amplifier thru 47K ohm resistor.	47.25Mc trap, L-104.	Minimum response at trap frequency (see curve #1). NOTE: Temporary reduction of bias and an increase of generator output may be required to see trap clearly.
2.	Same as Step #1.	Same as Step #1.	Both cores of 3rd IF transformer (L-107 and L-108).	Adjust for maximum response at 44Mc (see curve #2). NOTE: The 3rd IF transformer consists of two individual coils inductively coupled.
3.	Same as Step #1.	Same as Step #1.	1st IF coil (L-105).	Adjust for best overall response (see curve #2).
4.	To mixer T.P. M thru .001mf capacitor. Set sweep to 44Mc, markers as required. Remove by-pass capacitor from junction of L-103 and C-105 to ground.	Same as Step #1.	47.25Mc trap, L-102, 41.25Mc trap, L-101, and 37.5Mc trap, L-100.	Minimum response at proper trap frequency (see curve #3). NOTE: Temporary reduction of bias and and increase of generator output may be required to see trap clearly.
5.	Same as Step #4.	Same as Step #1.	Mixer plate coil, L-26, on tuner and 1st IF input coil, L-103.	To obtain curve #4. The mixer plate coil, L-26, affects the center peak or tilt and the 1st IF input coil affects the two outside peaks. Tune coils simultaneously for proper tuning and band-width consistent with maximum gain.


37.5 MC
41.25 MC
47.25 MC
42.25MC
45.75MC
1V PP
60%±20%
55%±5%
STEP 5
CURVE 4
ADJUST FOR FLAT RESPONSE
ADJUST FOR PROPER MARKER PLACEMENT
L101 (ON TOP) 41.25MC TRAP
L100 (ON TOP) 37.5MC TRAP
VTVM
T.P. M
VHF TUNER SCPTT-394
L26
SWEEP & MARKER GENERATOR
RF OUTPUT
GND
SCOPE
.001 MF
120
TERMINATION
L100
L101
L102
37.5 MC
41.25 MC
47.25 MC
STEP 4
CURVE 3
ADJUST TRAP FOR MARKER PLACEMENT
L103 1ST IF INPUT COIL
JUNCTION OF L103 & C105
T.P.-J
T.P.-K
100K
100K
T.P.-A
1ST IF (BASE)
4.5V BIAS SUPPLY
ADJUST TRAPS FOR MARKER PLACEMENT
47.25 MC
L104 (TOP CORE) 47.25MC TRAP
L105 (BOT CORE) 1ST IF COIL
(L106 UNTUNED)
STEP 1
CURVE 1
SCOPE
V
H
47K
ADJUST BOTH CORES FOR MAX RESPONSE AT 44MC AND PROPER MARKER PLACEMENT
L107 3RD IF PRI
L108 3RD IF SEC
1ST VIDEO AMP (BASE)
ADJUST BOTTOM CORE FOR BEST OVERALL RESPONSE
L105
STEP 2
1V PP
42.25MC
10% MAX DIP
45.75MC
40%±10%
40%±10%
STEP 3
44MC
STEPS 2 & 3
CURVE 2
SC-3131

VIDEO IF AND SOUND ALIGNMENT POINTS AND RESPONSE CURVES

SOUND ALIGNMENT (Station Signal Method)

The 2nd 4.5Mc amplifier stage is designed to oscillate at a frequency very close to 4.5Mc. The 4.5Mc input signal controls the frequency of its oscillation. The advantage of having the stage oscillate becomes apparent on weak signals because audio signals too weak to be heard above the noise level are strong enough to control the oscillations and result in a usable FM output signal.

PRELIMINARY STEPS

1. Connect a pair of 100K ohm resistors in series.
2. Connect above resistors across C-312 (T.P. "I").
3. Tune in a strong TV station and adjust fine tuning for maximum audio.
4. Refer to "Video IF and Sound Alignment Detail" for coil and test point locations.

STEP	STATION	INDICATOR	ADJUST	ADJUST FOR AND/OR REMARKS
1.	Strong signal	One lead of VTVM to junction of two 100K resistors, (T.P. K) other lead to junction of R-305 and C-311 (T.P. J). Set meter to zero center.	T-301 ratio detector transformer.	Detune secondary (bottom core) to give an indication on the meter. Note direction of meter indication. Leave core in this position.
2.	Strong signal	Same as Step #1.	Same as Step #1.	Adjust primary (top core) for maximum meter indication in same direction as noted in Step #1.
3.	Strong signal	Same as Step #1.	Interstage transformer, T-300.	Adjust for maximum output.
4.	Strong signal	Same as Step #1.	T-301 ratio detector transformer.	Adjust secondary (bottom core) for zero volts (center scale).
5.	Weak signal	Listening test.	Interstate transformer, T-300.	Reduce signal until considerable noise is present in audio. Signal input can be reduced by tuning into smear or reducing signal input to tuner. Adjust T-300 for minimum noise and best audio as judged by listening to output.

VHF TUNER SERVICE INSTRUCTIONS - SCPTT-394

1. On pre-set tuners, note position of oscillator rotor when dis-assembling to insure proper orientation when re-assembled.

2. Replace wafer in correct position; carefully make all necessary solder connections to the tuner base.

3. Determine correct rotation position of tuning shaft (see Step #1, "Removing Defective Wafers") and insert shaft thru wafers.

PRE-ALIGNMENT INSTRUCTIONS

Alignment of a tuner is very seldom needed and, unless unmistakeable evidence of tampering is found, should be the last resort. If alignment is attempted on a tuner in which a faulty component exists, successful alignment will have to be repeated when the real cause of the trouble is finally corrected.

Pre-alignment tests of the tuner should include voltage and resistance measurements, routine checks for bad soldering connections and contacts, visual inspection of circuits for overheated components and obvious wiring defects.

PRE-ALIGNMENT TESTS

1. Check tuner voltages. Use tuner schematic.

2. Check mechanical troubles.

3. Check response curve. Response curves are the quality indicators of tuner performance and should be checked. See "Tuner Alignment" procedure.

REMOVING DEFECTIVE WAFERS

1. Make note of the position of the wafers in respect to the tuner shaft prior to removing tuner shaft. The small identifying notch in the shaft opening of each wafer and the 45° chamfer on the end of the tuner shaft will aid in locating correct position.

2. Remove the shaft tension and detent spring located on the wafer shield and shaft retaining spring on front plate. Loosen the two hex head screws that secure the front plate assembly. Straighten the crimped end of the wafer retainer bar that protrudes thru the front plate assembly, unsolder the retainer bar from the center shield and remove the retainer bar.

3. Unsolder the components from the oscillator stator assembly and lift assembly out of tuner.

NOTE: Do not distort master oscillator coil, L-39, otherwise oscillator adjustment may be necessary.

4. Remove the two (2) hex head screws that secure the front plate assembly to tuner chassis and carefully slide tuner shaft with the front plate and oscillator rotor assembly out of tuner.

5. Unsolder all connections between the wafer being removed and the tuner base. Note the dressing of leads and components before lifting wafer out of tuner.

6. To dis-assemble the oscillator rotor assembly, remove the Tinnerman nut from the tuner shaft.

7. Re-assemble tuner in reverse order of dis-assembly.

REPLACING WAFERS

When replacing a wafer, see that all wafer rotor contacts are on the same channel. The small identifying "notch" in the shaft opening of each wafer will aid in locating positions.

VHF ALIGNMENT PROCEDURE - SCPTT-394

PRELIMINARY STEPS

1. Disable sweep circuits by disconnecting B++ leads from yoke.

2. If necessary, remove tuner from bracket and re-position for better accessibility. Secure in this position. Make certain a good ground is provided.

3. Connect a variable bias supply to tuner AGC line at feed-thru capacitor on top of tuner, point Ⓛ . Set bias to +3.5 volts.

4. Do not remove tuner cover. Make coil adjustment thru holes provided in tuner shield.

5. Connect sweep generator, properly terminated to antenna input terminals. See Figure #1A for sweep generator termination network.

6. Maintain .02 volt peak-to-peak output on scope.

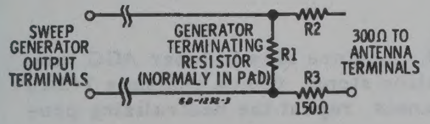
7. Refer to "Tuner Alignment Detail" (Figure #2) for marker placement on response curve.

8. For coil location, see the tuner's respective component location detail. See schematic diagram for detail of adjustment and test point (T.P.) locations.

9. Refer to Figure #1B for schematic diagram of scope detector probe.

STEP	TUNER CHANNEL SELECTOR	GENERATOR	INDICATOR	ADJUST	ADJUST FOR AND/OR REMARKS
1.	Channel 13	Connect to antenna terminal. Set generator for 10Mc. Sweep width at center of channel 13 (213Mc). Set marker generator as required in last column. See Figure #1 for generator termination.	Connect scope thru detector probe to mixer T.P. Ⓜ .	L-18 and L-19	Place video marker (211.25Mc) on or near the peak of the response curve (see Figure #2). Place sound marker (215.75Mc) on or near the peak of the response curve (see Figure #2). If bandwidth of response is too narrow or too wide, adjust by varying the high band coupling between the RF collector and mixer base wafers.
				L-9 (antenna)	If excessive tilt is evident, adjust for maximum amplitude and minimum tilt by spreading or compressing coil with a non-metallic tool.
2.	Channel 7	Same as Step #1 except set generator to center frequency of channel 7 (177Mc). Set marker generator as required in last column.	"	Touch up L-18 and L-19, if necessary.	Adjust for proper marker placement (175.25Mc Video & 179.75Mc Sound), (see Figure #2). NOTE: Repeat Steps #1 and #2 until channels 7 and 13 response is within specified limits. Channels 12 thru 8 will automatically fall within limits.
3.	Channel 6 thru 2	Same as Step #1 except set generator for correct center frequency of the respective channel. See channel chart (Figure #3) for correct frequency.	"	RF collector coil and mixer base coil (see chart).	Spread or compress the RF collector and mixer base coils of the respective channels for proper marker placement of video and sound marker on response curve as shown in Figure #2. If excessive tilt is evident, adjust the respective antenna coil. See Channel Chart (Figure #3) for correct video and sound marker frequencies of the respective channels.

Channel	Antenna Coil	RF Collector Coil	Mixer Base Coil
6	L-8	L-17	L-25
5	L-7	L-16	L-24
4	L-6	L-15	L-23
3	L-5	L-14	L-22
2	L-4	L-13	L-21


SWEEP GENERATOR OUTPUT TERMINALS
GENERATOR TERMINATING RESISTOR (NORMALY IN PAD)
R1
R2
R3
150Ω
300Ω TO ANTENNA TERMINALS
68-1232-3

GEN. OUTPUT	R1	R2
50	50	125
75	75	115
150	150	75
300	Connect to antenna terminal	

Use the combination of resistors shown in table to match generator output impedance. Use nearest RMA values.

FIGURE 1A - GENERATOR MATCHING NETWORK FOR TUNER ALIGNMENT

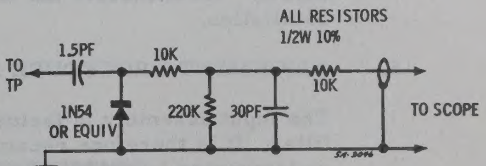


FIGURE 1B - SCOPE DETECTOR PROBE

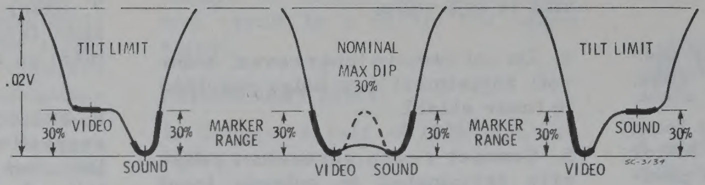


FIGURE 2 - ALIGNMENT DETAIL

Channel	Sweep Gen	MARKER Sound Mc	GENERATOR Video Mc
2 (54-60Mc)	57Mc	59.75	55.25
3 (60-66Mc)	63Mc	65.75	61.25
4 (66-72Mc)	69Mc	71.75	67.25
5 (76-82Mc)	79Mc	81.75	77.25
6 (82-88Mc)	85Mc	87.75	83.25
7 (174-180Mc)	177Mc	179.75	175.25
8 (180-186Mc)	183Mc	185.75	181.25
9 (186-192Mc)	189Mc	191.75	187.25
10 (192-198Mc)	195Mc	197.75	193.25
11 (198-204Mc)	201Mc	203.75	199.25
12 (204-210Mc)	207Mc	209.75	205.25
13 (210-216Mc)	213Mc	215.75	211.25

FIGURE 3 - CHANNEL CHART

4. NEUTRALIZATION OF THE RF AMPLIFIER (Channels 7 thru 13)

A. Set tuner to channel 13.

B. Set sweep generator to 213Mc.

C. Set bias on tuner AGC line (point L on tuner) to +3.5V.

D. Connect scope thru 47K to base of video amplifier, Q-4.

E. Adjust generator output for response curve similar to Figure #4 and amplitude of .2 mv.

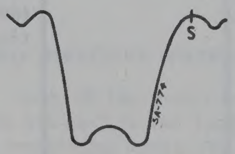


FIGURE 4

F. Adjust neutralizing capacitor, C-8, for null or minimum output. Restore bias to tuner AGC line, if RF amplifier breaks into oscillation, readjust C-8 until oscillation stops. Check channels 2 thru 13. If RF amplifier breaks into oscillation on any of these channels, repeat the neutralizing procedure.

NOTE: An excessive tilt of the response curve that increases when the bias is restored indicates oscillation.

5. ALIGNMENT PROCEDURE FOR TUNER INPUT FILTER ASSEMBLY (E-7)

The input assembly is factory aligned in a test fixture after which the tuner is aligned to match the filter. It is therefore recommended that the filter not be field aligned. Should obvious coil damage or tampering be evident, it is recommended that the filter be replaced as an assembly.

OSCILLATOR ALIGNMENT

This tuner employs a pre-set oscillator adjustment screw for each channel. Normally, adjustment is not necessary other than the normal fine tuning adjustment.

If all of the available stations cannot be received and it is evident that the fine tuning range is not adequate, adjust master oscillator coil, L-39, as per Step #6.

STEP	TUNER CHANNEL SELECTOR	SWEEP AND MARKER GENERATOR FREQUENCY	INDICATOR	ADJUST	ADJUST FOR AND/OR REMARKS
6.	Channel 13 and the fine tuning screw adjusted to its mechanical mid-position.	Refer to "Channel Chart", Figure #3, for sweep and sound marker frequency. Adjust sweep generator for response curve as shown in Figure #4.	Scope thru 47K ohm resistor to base of video amplifier, Q-4.	Master oscillator coil, L-39.	Sound marker must fall into 41.25Mc trap dip within 500Kc of specified sound marker frequency (215.75Mc).

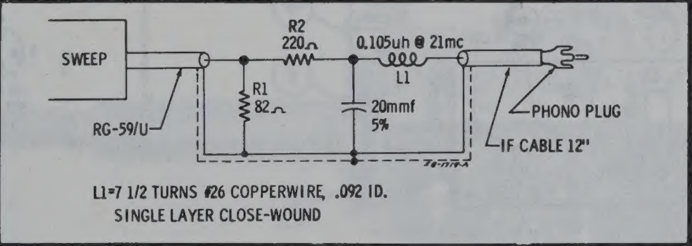
NOTE: With the master oscillator coil, L-39, properly adjusted for channel 13, all other channels will fall within the normal range of the fine tuning adjustment.

UHF INPUT ALIGNMENT

Pre-Alignment Instructions

1. Coils are accessible thru holes provided in shield.
2. Set bias on tuner AGC line (point L) to +3.5V.
3. Set tuner to channel one (1) position.

STEP	TUNER CHANNEL SELECTOR	GENERATOR	INDICATOR	ADJUST	ADJUST FOR AND/OR REMARKS
7.	UHF (Channel 1)'	Sweep generator at 44Mc and 10Mc sweep width. Connect to UHF input receptacle of VHF tuner thru network shown in Figure #5. Set marker generator as given in last column.	Scope thru detector probe to mixer T.P. Ⓜ.	L-12 (RF plate) L-20 (mixer)	Place audio marker (41.25Mc) and video marker (45.75Mc) symmetrically on response curve as shown in Figure #6.



GEN. OUTPUT Z	R-1
50	56
75	82
150	150
300	330

FIGURE 5 - GENERATOR MATCHING NETWORK (40MC CHANNEL 1 ALIGNMENT)

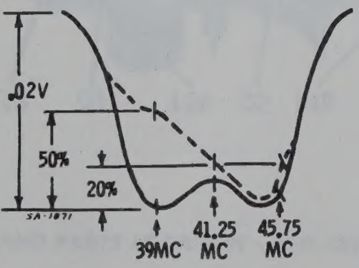
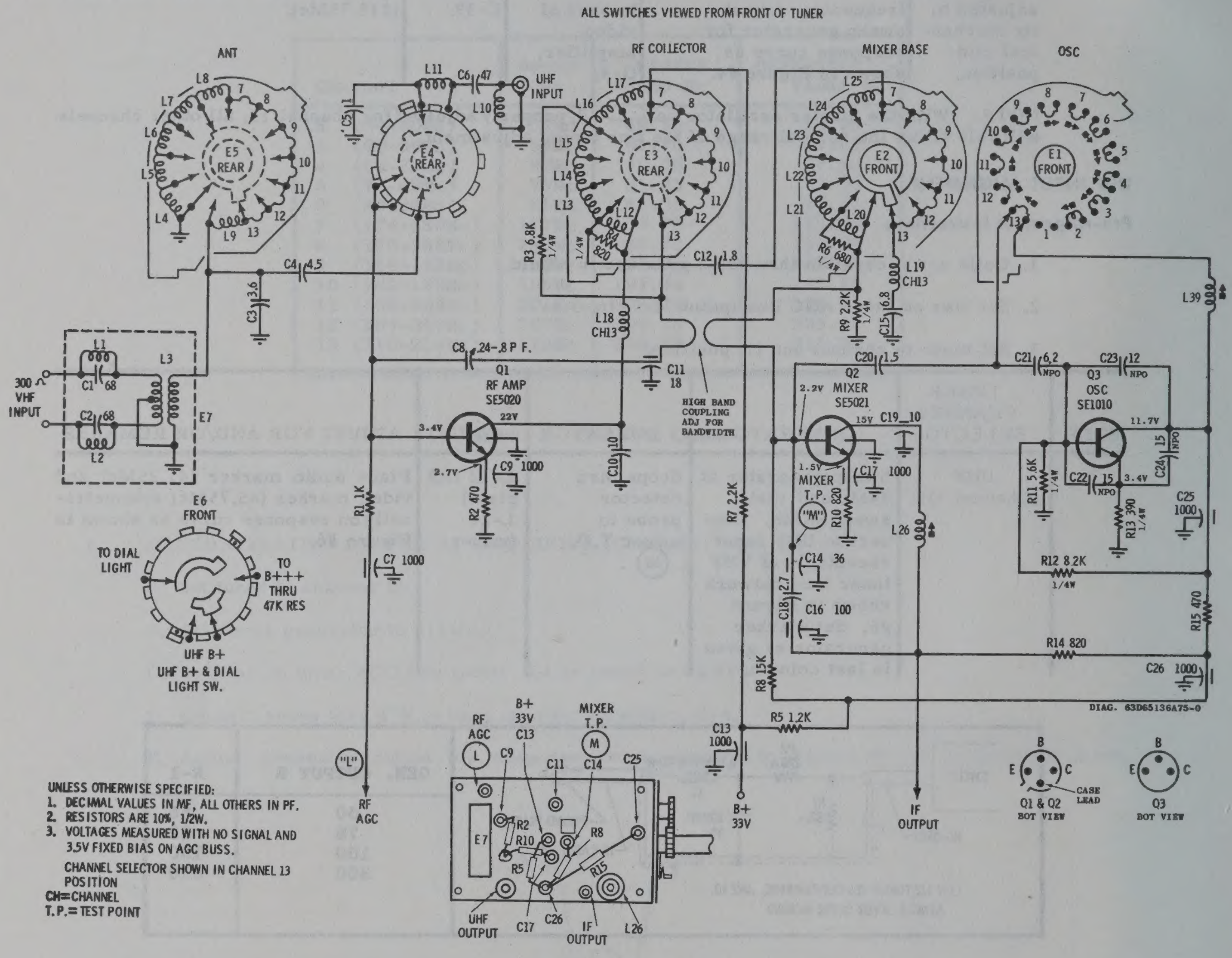


FIGURE 6 - ALIGNMENT DETAIL (40MC CHANNEL RESPONSE)

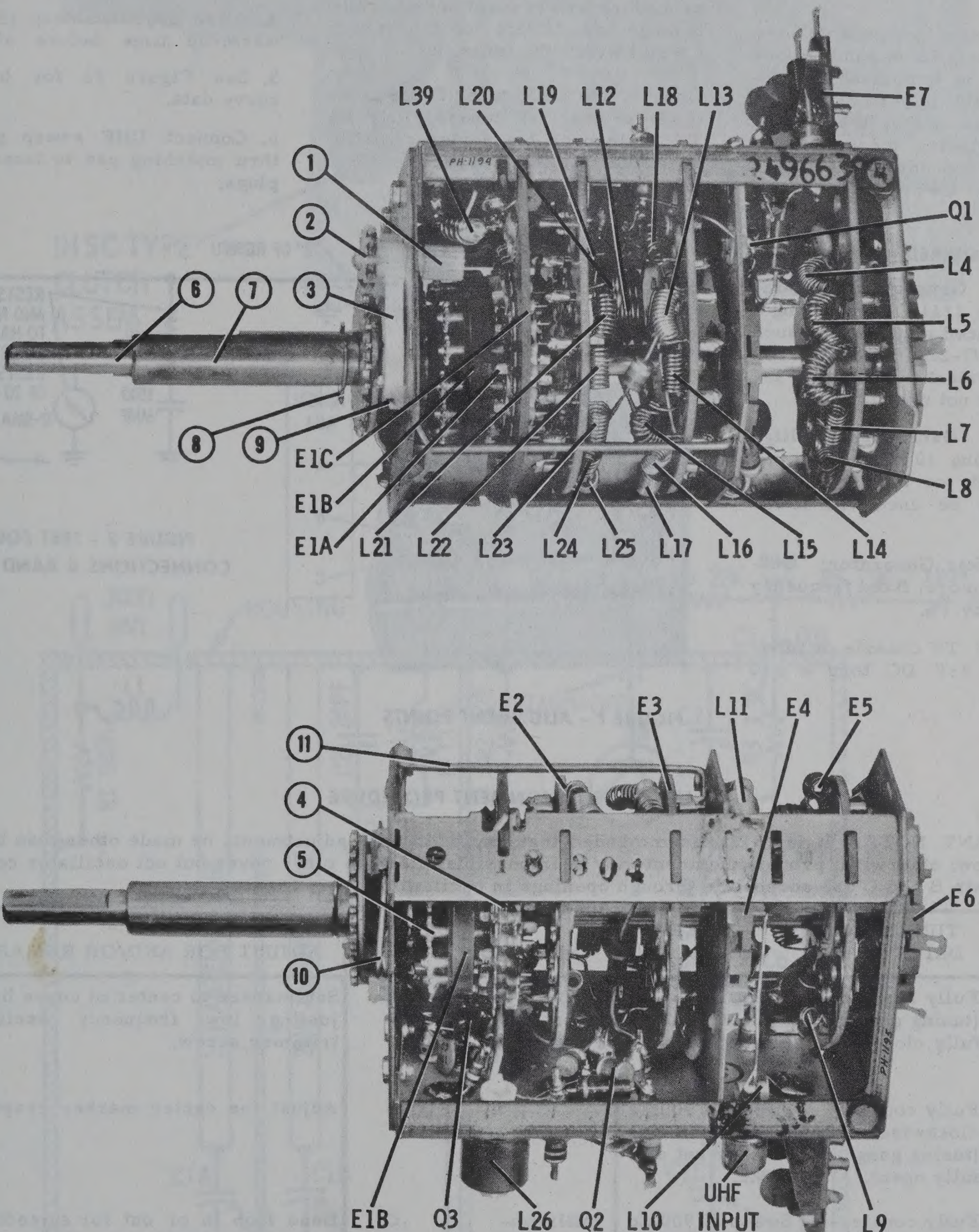


ALL SWITCHES VIEWED FROM FRONT OF TUNER
ANT
RF COLLECTOR
MIXER BASE
OSC
E5 REAR
E4 REAR
E3 REAR
E2 FRONT
E1 FRONT
UHF INPUT
L11
C6 47
L10
C5
L8
L7
L6
L5
L4
L9
L17
L16
L15
L14
L13
L12
R4 820 1/4W
R3 6.8K 1/4W
L25
L24
L23
L22
L21
L20
R6 680 1/4W
C4 4.5
C3 3.6
C12 1.8
L19 CH13
R9 2.2K 1/4W
C15 6.8
L18 CH13
L39
300 VHF INPUT
L1
C1 68
L2
C2 68
L3
E7
C8 .24-.8 P F.
Q1 RF AMP SE5020
C11 18
HIGH BAND COUPLING ADJ FOR BANDWIDTH
C20 1.5
C21 6.2 NPO
C23 12 NPO
Q2 MIXER SE5021
Q3 OSC SE1010
3.4V
22V
2.7V
C9 1000
C10 10
R2 470
R1 1K
2.2V
15V
C19 10
1.5V
C17 1000
MIXER T.P.
R10 820
"M"
R7 2.2K
L26
11.7V
C24 15 NPO
C22 15 NPO
3.4V
R11 5.6K 1/4W
R13 390 1/4W
C25 1000
R12 8.2K 1/4W
R15 470
R14 820
C26 1000
C14 36
C18 2.7
C16 100
R8 15K
R5 1.2K
C13 1000
B+ 33V
IF OUTPUT
DIAG. 63D65136A75-0
E6 FRONT
TO DIAL LIGHT
TO B+++ THRU 47K RES
UHF B+
UHF B+ & DIAL LIGHT SW.
C7 1000
"L"
RF AGC
RF AGC
B+ 33V
C13
MIXER T.P.
C9
C11
C14
C25
E7
R2
R10
R8
R5
R15
UHF OUTPUT
C17
C26
IF OUTPUT
L26
B
E
C
CASE LEAD
Q1 & Q2 BOT VIEW
Q3 BOT VIEW

UNLESS OTHERWISE SPECIFIED:
1. DECIMAL VALUES IN MF, ALL OTHERS IN PF.
2. RESISTORS ARE 10%, 1/2W.
3. VOLTAGES MEASURED WITH NO SIGNAL AND 3.5V FIXED BIAS ON AGC BUSS.

CHANNEL SELECTOR SHOWN IN CHANNEL 13 POSITION
CH=CHANNEL
T.P.=TEST POINT

SCHEMATIC DIAGRAM - VHF TUNER - SCPTT-394


L39
L20
L19
L12
L18
L13
E7
1
2
3
6
7
Q1
L4
L5
L6
L7
L8
8
9
E1C
E1B
E1A
L21
L22
L23
L24
L25
L17
L16
L15
L14
PH-1194
2496639
E2
E3
L11
E4
E5
11
4
5
E6
10
18304
PH-1195
E1B
Q3
L26
Q2
L10
UHF
INPUT
L9

ALIGNMENT POINTS AND PARTS LOCATION - VHF TUNER - SCPTT-394

UHF TUNER ALIGNMENT - KTT-622

The UHF output signal is coupled to VHF tuner with inter-connecting cables. B+ voltage of the UHF tuner is obtained by an inter-connecting lead between the UHF tuner and VHF tuner. It is possible to gain sufficient room between the tuners for adjustment without the necessity of breaking and re-connecting the leads if meticulous care is taken.

The UHF tuner components are rugged mechanisms and unless obvious damage or tampering has occured, it should only be necessary to align the oscillator tracking to RF when replacing the transistor and to check and adjust the mixer crystal current for proper operating limits.

EQUIPMENT REQUIRED

UHF Sweep Generator: Tel-instrument type 1211, 1211S having a 300 ohm balanced matching pad such as the RCA WG-224, WG-223, TIC-1655 or equivalent instrument. Internal marker not used.

Cathode Ray Oscilloscope: High gain type having 10 milli-volts per inch sensitivity or better. (Scope pre-amp may be used with lower gain types.)

External Marker Generator: Output .1 volt or more; fixed frequency 44Mc; accuracy 1%.

Power Supply: TV chassis or other shop supply, 33V DC thru a 270 ohm resistor.

Milliammeter: 0-5 Ma range (20 ohms for total resistance of injection metering circuit).

TUNER CONNECTIONS

CAUTION: It is imperative that a good ground connection exist between the power source and the tuner housing before applying power. This procedure will prevent any possible damage or failure of the mixer crystal within the tuner.

Connect the UHF tuner B+ tie point (C-5) to the VHF tuners "UHF B+ T.P.", through the series resistor specified in the respective UHF tuners schematic diagram.

PRE-ALIGNMENT NOTES

1. Disable the horizontal output section by removing Q-18.

2. Use Figures #1 and #2 for test equipment connections and adjustment locations.

3. Oscillator cover must be in place during alignment.

4. Allow approximately 15 minutes warm-up time before alignment.

5. See Figure #2 for band-pass curve data.

6. Connect UHF sweep generator thru matching pad to tuner antenna plugs.

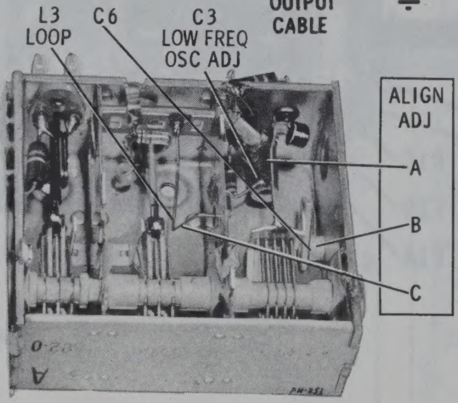


FIGURE 1 - ALIGNMENT POINTS

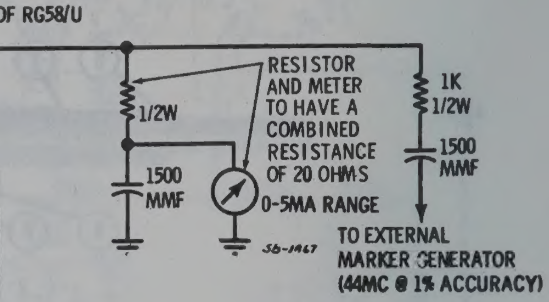


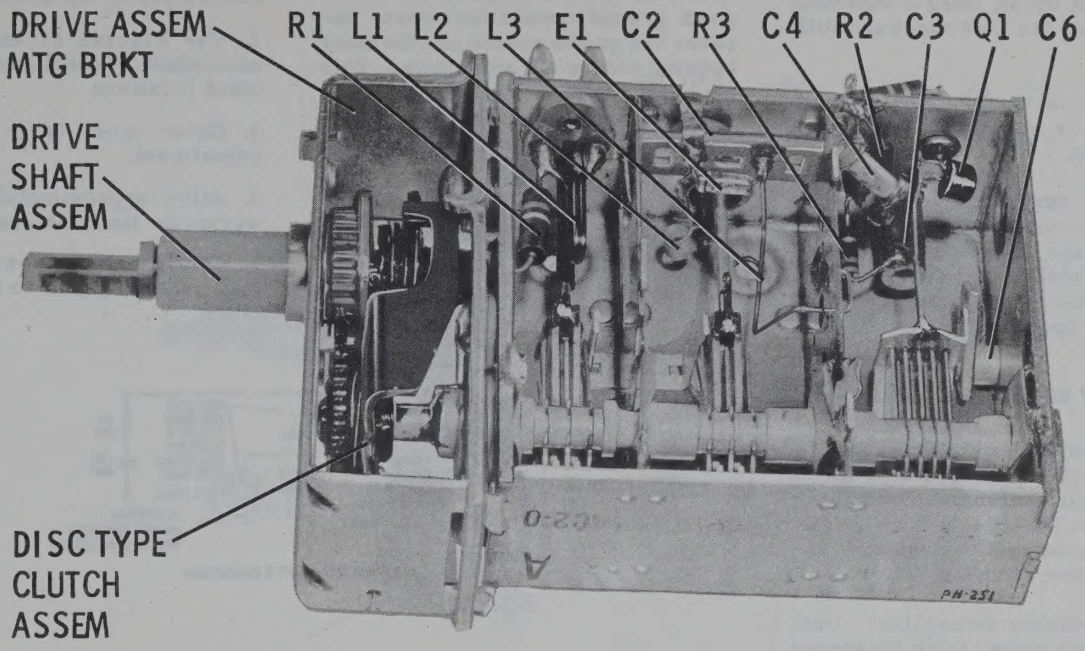
FIGURE 2 - TEST EQUIPMENT CONNECTIONS & BAND PASS CURVE

UHF TUNER ALIGNMENT PROCEDURE

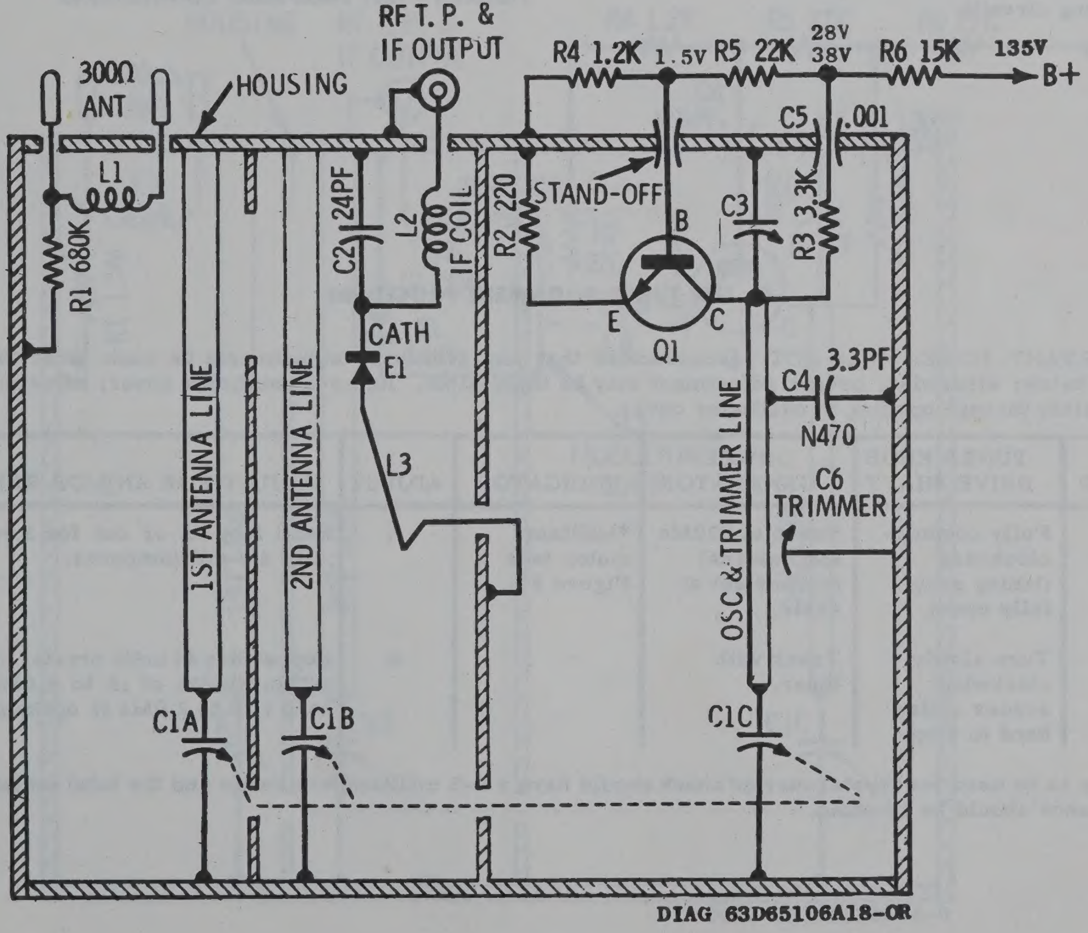
IMPORTANT NOTE: It is NOT recommended that any additional adjustments be made other than those given below; otherwise, proper alignment may be impossible. Remove tuner cover but not oscillator cover; adjustments B and C are accessible through openings in oscillator cover.

STEP	TUNER KNOB DRIVE SHAFT	SWEEP GENERATOR	INDICATOR	ADJUST	ADJUST FOR AND/OR REMARKS
1.	Fully clockwise (tuning gang fully closed).	Sweep at 468Mc and external market set at 44Mc.	Scope at tuner output (see Figure #2).	A	Set marker to center of curve by adjusting low frequency oscillator trimmer screw.
2.	Fully counter-clockwise (tuning gang fully open).	Sweep at 900Mc and external marker set at 44Mc.	"	B	Adjust for center marker response.
3.	Fully counter-clockwise (tuning gang fully open).	Sweep at 900Mc and external marker set at 44Mc.	*Milliammeter (see Figure #2).	C	Bend loop in or out for a reading of .5 to 2.25 milliamperes.
4.	Turn slowly clockwise across entire band to stop.	Track with tuner.	"	C	Repeat Step #3 until crystal current is within limits of .5 to 5.5Ma across band (1.0 to 2.0Ma is optimum).

*Meter to be used for crystal current check should have a 0-5 milliampere range and the total meter circuit resistance should be 20 ohms.


DRIVE ASSEM
MTG BRKT
DRIVE
SHAFT
ASSEM
DISC TYPE
CLUTCH
ASSEM
R1
L1
L2
L3
E1
C2
R3
C4
R2
C3
Q1
C6
PH-251

UHF TUNER KTT-622 COMPONENT LOCATION


300Ω
ANT
HOUSING
RF T. P. &
IF OUTPUT
L1
R1 680K
C2 24PF
L2 IF COIL
CATH
E1
L3
1ST ANTENNA LINE
2ND ANTENNA LINE
R4 1.2K
1.5V
R5 22K
28V
38V
R6 15K
135V
B+
C5 .001
R2 220
STAND-OFF
B
C3
R3 3.3K
E
C
Q1
C4 3.3PF
N470
C6
TRIMMER
OSC & TRIMMER LINE
C1A
C1B
C1C
DIAG 63D65106A18-OR

SCHEMATIC DIAGRAM - UHF TUNER KTT-622

The UHF output signal is coupled to VHF tuner with inter-connecting cables. B+ voltage of the UHF tuner is obtained by an inter-connecting lead between the UHF tuner and VHF tuner.

The tuner is factory pre-aligned. Alignment is not necessary or recommended.

The UHF tuner components are rugged mechanisms and unless obvious damage or tampering has occurred, it should only be necessary to adjust the mixer crystal current for proper operating limits.

EQUIPMENT REQUIRED

UHF Sweep Generator: Tel-instrument type 1211, 1211S having a 300 ohm balanced matching pad such as the RCA WG-224, WG-223, TIC-1655 or equivalent instrument. Internal marker not used.

External Marker Generator: Output .1 volt or more; fixed frequency 44Mc; accuracy 1%.

Power Supply: TV chassis or other shop supply (33V DC thru a 270 ohm resistor).

Milliammeter: 0-5 Ma range (20 ohms for total resistance of injection metering circuit).

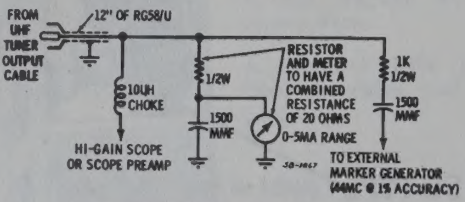
TUNER CONNECTIONS

CAUTION: It is imperative that a good ground connection exists between the power source and the tuner housing before applying power. This procedure will prevent any possible damage or failure of the mixer crystal within the tuner.

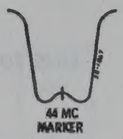
Connect the UHF tuner B+ tie point (C-5) to the VHF tuners "UHF B+ T.P." through the series resistor specified in the respective UHF tuners schematic diagram.

PRE-ALIGNMENT NOTES

1. Disable the horizontal output section by removing Q-18.
2. Use Figures #1 and #2 for test equipment connections and adjustment locations.
3. Cover must be in place during adjustment.
4. Allow approximately 15 minutes warm-up time before adjustment.
5. Connect UHF sweep generator thru matching pad to tuner antenna plugs.


FROM UHF TUNER OUTPUT CABLE
12" OF RG58/U
10UH CHOKE
HI-GAIN SCOPE OR SCOPE PREAMP
1/2W
1500 MMF
RESISTOR AND METER TO HAVE A COMBINED RESISTANCE OF 20 OHMS
0-5MA RANGE
SB-1067
1K 1/2W
1500 MMF
TO EXTERNAL MARKER GENERATOR (44MC @ 1% ACCURACY)

ALIGNMENT TEST POINTS & CONNECTIONS



IDEAL BANDPASS CURVE

FIGURE 1 - TEST EQUIPMENT CONNECTIONS

UHF TUNER ALIGNMENT PROCEDURE

IMPORTANT NOTE: It is NOT recommended that any additional adjustments be made other than those given below; otherwise, proper adjustment may be impossible. Remove oscillator cover; adjustments are accessible through opening in oscillator cover.

STEP	TUNER KNOB DRIVE SHAFT	SWEEP GENERATOR	INDICATOR	ADJUST	ADJUST FOR AND/OR REMARKS
1.	Fully counter-clockwise (tuning gang fully open).	Sweep at 900Mc and external marker set at 44Mc.	*Milliammeter (see Figure #1).	A	Bend loop in or out for a reading of .5 to 4.0 milliamperes.
2.	Turn slowly clockwise across entire band to stop.	Track with tuner.	"	A	Repeat Step #1 until crystal current is within limits of .5 to 4.0Ma across band (1.0 to 2.0Ma is optimum).

*Meter to be used for crystal current check should have a 0-5 milliampere range and the total meter circuit resistance should be 20 ohms.

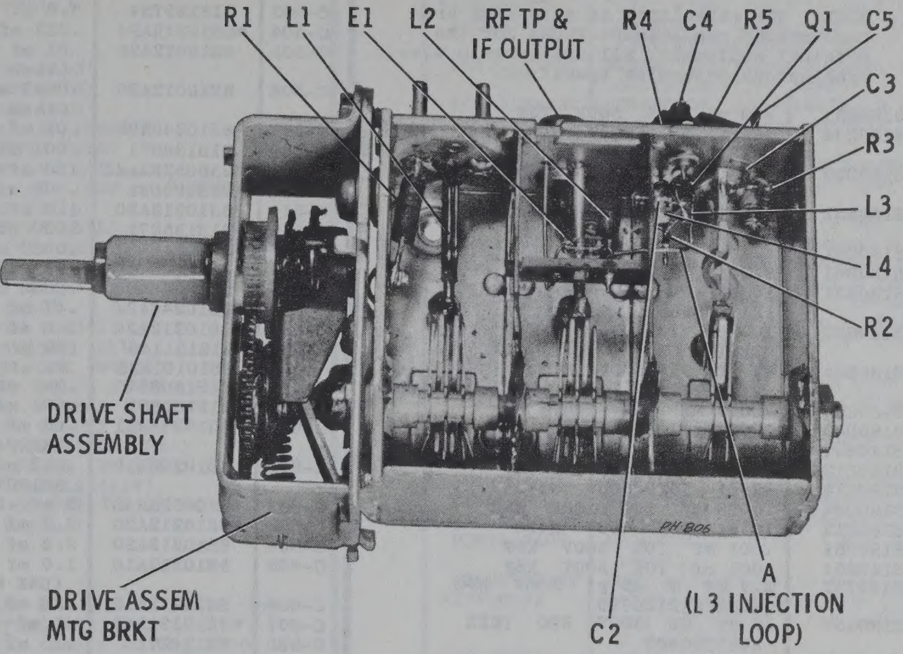
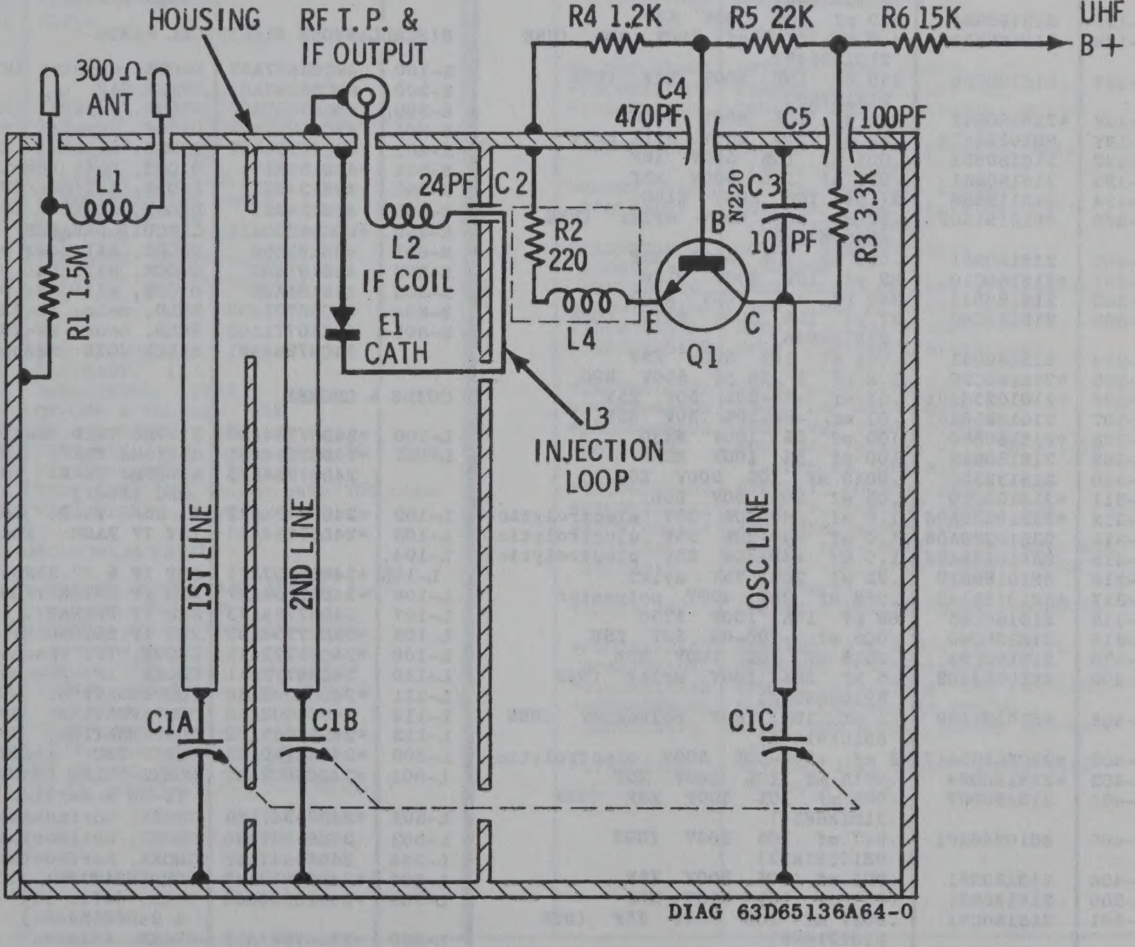

R1
L1
E1
L2
RF TP &
IF OUTPUT
R4
C4
R5
Q1
C5
C3
R3
L3
L4
R2
DRIVE SHAFT
ASSEMBLY
DRIVE ASSEM
MTG BRKT
C2
A
(L3 INJECTION
LOOP)
PH 806

FIGURE 2 - UHF TUNER KTT-626 COMPONENT LOCATIONS


HOUSING
RF T.P. &
IF OUTPUT
300 Ω
ANT
L1
R1 1.5M
R4 1.2K
R5 22K
R6 15K
UHF
B+
C4
470PF
C5
100PF
24PF
C2
C3
10 PF
N220
B
R3 3.3K
R2
220
L2
IF COIL
E1
CATH
L4
E
C
Q1
L3
INJECTION
LOOP
1ST LINE
2ND LINE
OSC LINE
C1A
C1B
C1C
DIAG 63D65136A64-0

SCHEMATIC DIAGRAM - UHF TUNER KTT-626

REPLACEMENT PARTS LIST

Ref. No.	Part Number	Description
		ELECTRICAL PARTS
CAPACITORS - NOTE:		The capacitors in this list are recommended replacement types for the original equipment; all are ceramic disc type unless otherwise specified.
C-100	*21S180B53	470 pf 10% 500V X5F
C-101	21S180C04	56 pf 10% 500V NPO (USE 21S180A79)
C-102	21S180D20	18 pf 10% 500V N150 (USE 21R120578)
C-102	21S180A51	15 pf 5% 500V NPO (A-01 and later)
C-103	*21S180C91	6.8 pf ± .25 pf 500V N150
C-104	21S180B61	8.2 pf ± .25 pf 500V NPO
C-105	21S180A51	15 pf 5% 500V NPO (USE 21S125066)
C-106	21S180B92	100 pf 10% 100V N330 (USE 21S132518)
C-107	21S180B45	47 pf 5% 500V N150 (USE 21S122822)
C-108	*21S180C94	.0018 mf 10% 100V Z5E
C-109	21S180D40	.005 mf ± 100% 50V Z5U
C-110	21S180B51	.001 mf 10% 500V X5F
C-111	*21S180C12	10 pf 10% 500V N470
C-112	*21S180C14	82 pf 10% 500V N470
C-113	21S180C94	.0018 mf 10% 100V Z5E
C-114	21S180C12	10 pf 10% 500V N470
C-116	21S180B51	.001 mf 10% 500V X5F
C-117	21S180B51	.001 mf 10% 500V X5F
C-118	21S129737	2.7 pf ± .25 pf 500V NPO (USE 21R125699)
C-119	21S180A51	15 pf 5% 500V NPO (USE 21S125066)
C-120	*21S180C95	.0015 mf 10% 100V Z5E
C-121	21S180B49	10 pf ± .5 pf 500V NPO (USE 21S410063)
C-122	21S180B58	100 pf 5% 100V N330 (USE 21S180B97)
C-123	21S180B51	.001 mf 10% 500V X5F
C-124	21S180B50	4.7 pf ± .5 pf 500V NPO (USE 21S122942)
C-125	21S180B53	470 pf 10% 500V X5F
C-126	21S180B50	4.7 pf ± .5 pf 500V NPO (USE 21S122942)
C-127	21S180C06	330 pf 10% 500V Z5F (USE 21S127090)
C-128	*21S180B47	220 pf 10% 500V N750
C-131	8S10212A12	.22 mf 20% 250V mtlz poly
C-132	21S180B51	.001 mf 10% 500V X5F
C-133	21S180B51	.001 mf 10% 500V X5F
C-134	21S119896	27 pf 10% 500V N150
C-200	8S10191A02	.22 mf 20% 400V mylar (USE 8S10064A12)
C-300	21S180B51	.001 mf 10% 500V X5F
C-301	*21S180C10	82 pf 10% 500V N150
C-302	21S180B47	220 pf 10% 500V N750
C-303	21S180C90	27 pf 10% 500V N470 (USE 21R124946)
C-304	21S180B51	.001 mf 10% 500V X5F
C-305	*21S180C29	1.8 pf ± .25 pf 500V NPO
C-306	*21G10256A01	.01 mf +80-20% 50V Z5V
C-307	21G10256A01	.01 mf +80-20% 50V Z5V
C-308	*21S180B59	100 pf 5% 100V N330
C-309	21S180B59	100 pf 5% 100V N330
C-310	21S132350	.0015 mf 10% 500V X5F
C-311	*21S180C70	.05 mf 20% 50V Z5U
C-312	*23S10229A06	1.0 mf +40-20% 25V electrolytic
C-313	23S10229A06	1.0 mf +40-20% 25V electrolytic
C-315	23S10229A06	1.0 mf +40-20% 25V electrolytic
C-316	8S10169B10	.22 mf 20% 75V mylar
C-317	*8S10191A43	.068 mf 20% 400V polyester
C-318	21S180C65	68 pf 10% 100V N750
C-319	21S180D40	.005 mf +100-0% 50V Z5U
C-320	21S180C94	.0018 mf 10% 100V Z5E
C-400	8S10064A03	.5 mf 20% 100V mylar (USE 8R10064B23)
C-401	8S10191A38	.1 mf 10% 160V polyester (USE 8S10191A46)
C-402	*23C66135A17	2 mf +100-10% 500V electrolytic
C-403	*21S180D24	.0015 mf 10% 100V X5F
C-404	21S180B67	.005 mf 10% 500V Z5F (USE 21R128634)
C-405	8G10246A01	.047 mf 10% 160V (USE 8S10191A32)
C-406	21S180B51	.001 mf 10% 500V X5F
C-500	21S180B51	.001 mf 10% 500V X5F
C-501	21S180C41	.0027 mf 10% 500V Z5F (USE 21S121699)

Ref. No.	Part Number	Description
C-502	23S10229A07	1.0 mf +40-20% 15V electrolytic (USE 23C43280A17)
C-503	21S129734	5.6 pf ± .5 pf 500V N150
C-504	*8S10212A24	.033 mf 10% 250V mtlz poly
C-505	8S10072A28	.01 mf 10% 100V poly mylar class E (USE 8S10064A07)
C-506	8S10072A29	.0082 mf 10% 100V poly mylar class E (USE 8S10064A35)
C-507	8G10246A05	.01 mf 20% 160V (USE 8S10191A35)
C-508	21S180B51	.001 mf 10% 500V X5F
C-509	*23D65282A40	150 mf/10V electrolytic
C-510	*21S180D31	.005 mf 20% 1KV Z5F
C-511	*8S10212A30	1.0 mf 20% 630V mtlz poly
C-512	*21S135871	1000 pf 20% 1KV Z5U feed-thru
C-513	8G10246A07	.0068 mf 10% 1000V (USE 8S10064B30)
C-514	*8G10246A06	.0022 mf 10% 1000V
C-515	*8G10246A24	.47 mf 10% 200V
C-516	*8S10212A29	1.0 mf 20% 100V mtlz poly
C-517	*21R131149	150 pf 10% 500V Z5F (B-00 & earlier)
	8S10191A35	.01 ufd 10% 160V (B-01 & later)
C-518	21S180B51	.001 mf 10% 500V X5F
C-519	21S180B51	.001 mf 10% 500V X5F
C-600	8G10246A11	.05 mf 20% 100V (USE 8K129455)
C-601	8G10246A10	.012 mf 10% 100V (USE 8R10072A11)
C-602	*23D65282A37	5 mf +50-10% 50V
C-603	*8S10212A20	2.2 mf 10% 100V mtlz poly
C-604	8S10212A20	2.2 mf 10% 100V mtlz poly
C-605	8S10212A10	1.0 mf 10% 100V mtlz poly (USE 8S135708)
C-606	8S10212A12	.22 mf 20% 250V mtlz poly
C-607	*8S10191A46	.1 mf 10% 160V polyester
C-800	8S134271	.15 mf 20% 400V
C-801	*21S132293	1000 pf +100-0% 500V Z5U
C-802	21S132293	1000 pf +100-0% 500V Z5U
C-804	*23C65891A06	40 mf/300V, 40 mf/300V
C-805	23C65891A06	40 mf/300V, 40 mf/300V
C-806	*23C65807A29	400 mf/125V, 60 mf/40V, 350 mf/100V, 200 mf/40V
C-807	23C65808A12	50 mf/50V electrolytic (USE 23C60119A06)
MISCELLANEOUS ELECTRICAL PARTS		
E-100	48C65837A02	DIODE, crystal (video detector)
E-200	80C68147A01	SPARK GAP
E-300	48C65837A02	DIODE, crystal (ratio det)
E-301	48C65837A02	DIODE, crystal (ratio det)
E-401	48C67120A02	DIODE, crystal (AGC gate)
E-501	*48S134917	DIODE, dual (horiz phase det)
E-502	*48S134921	DIODE, silicon (D1D) pulse limiter
E-503	48S134921	DIODE, silicon (D1D) damper
E-800	*80C66390A18	CIRCUIT BREAKER
E-801	48S191A06	DIODE, silicon: power rectifier
E-802	48S191A05	DIODE, silicon: power rectifier
E-803	48S191A05	DIODE, silicon: power rectifier
E-804	65C66771A03	BULB, neon: NE-2H
E-805	65C66771A03	BULB, neon: NE-2H
	24C67284A01	BALUN COIL: monopole antenna
COILS & CHOKES		
L-100	*24D67754A20	37.5Mc TRAP: incls core
L-101	*24D67754A21	41.25Mc TRAP: incls core
	24D67754A23	41.25Mc TRAP: incls core (A-01 and later)
L-102	*24D67754A22	47.25Mc TRAP: incls core
L-103	*24D67754A23	1ST IF BASE: incls core
L-104, L-105	*24V68607A31	1ST IF & 47.25Mc TRAP: incl core
L-106	*24D67754A27	2ND IF INTERSTAGE
L-107	24D67754A23	3RD IF PRIMARY: incls core
L-108	*24D67754A25	3RD IF SECONDARY: incls core
L-109	*24C66772A11	CHOKE, IF: resonant 8.8 uh
L-110	24C66772A11	CHOKE, IF: resonant 8.8 uh
L-111	*24D68002A38	COMPENSATING: 900 uh
L-112	24D68002A38	COMPENSATING: 900 uh
L-113	*24D68002A42	COMPENSATING: 200 uh/18K
L-500	*24D68130A03	HORIZ OSC: incls core
L-501	*24D68002A35	HORIZ PULSE SHAPING: 6600 uh/10K (B-00 & earlier only)
L-502	*24D65947A85	CHOKE, horizontal suppressor
L-503	24D65947A86	CHOKE, horizontal suppressor
L-504	24D65947A88	CHOKE, horizontal suppressor
L-600	*24D68002A40	COMPENSATING: 1000 uh/39 ohm
L-700	*24G10250A04	YOKE, defl: 114° (P/N 24D68523A01 & 24D68554A01)
L-800	*25D67554A11	CHOKE, filter

Ref. No.	Part Number	Description
L-801	24V68611A85	CHOKE, line
	24C66772A11	CHOKE, IF resonant: 8.8 uh (balun choke)
TRANSISTORS		
Q-1	48S134904	1ST IF AMP (A1G)
Q-2	48S134904	2ND IF AMP (A1G)
Q-3	48S134932	3RD IF AMP (A1U)
Q-4	48S134841	1ST VIDEO AMP (M4841)
Q-5	48S134927	VIDEO OUTPUT (A1S)
Q-6	48S134918	1ST 4.5Mc AMP (A1L)
Q-7	48S134970	2ND 4.5Mc. AMP (A2T or 2N3694)
Q-8	48S134918	AUDIO AMP (A1L)
Q-9	48S134918	AUDIO DRIVER (A1L)
Q-10	48S134972	AUDIO OUTPUT (A2U USE 48S134920 A1N)
Q-11	*48S134933	AGC GATE (A1V)
Q-12	48S134910	AGC AMP (P1C)
Q-13	48S134842	NOISE GATE (M4842)
Q-14	*48S134933	SYNC SEPARATOR (A1V)
Q-15	48S134842	HORIZONTAL OSC (M4842)
Q-16	48S134910	HORIZONTAL PULSE SHAPER (P1C)
Q-17	48S134919	HORIZONTAL DRIVER (A1M)
Q-18	48S134901	HORIZONTAL OUTPUT (A1D)
Q-21	48S134943	VERTICAL DISCHARGE (P1J)
Q-22	48S134933	VERTICAL PULSE INV (A1V)
Q-23	48S134933	VERTICAL DRIVER (A1V)
Q-24	48S134900	VERTICAL OUTPUT (A1C)
Q-25	48S134943	AGC DELAY (P1J)
TRANSFORMERS		
T-100	*24D68822A02	4.5Mc TRAP & A.T.O.: incls core
T-300	*24D68822A01	4.5Mc INTERSTAGE
T-301	24V66550A80	RATIO DET: incls E-300, E-301, C-308, C-309, C-310, R-306
T-302	*25D67552A16	AUDIO OUTPUT
T-500	*25D67440A03	HORIZONTAL DRIVER
T-501	*24D68804A03	HORIZONTAL OUTPUT TRANSFORMER: complete pri-sec winding can be purchased separately
	*24D67601A11	PRIMARY/SECONDARY OF T-501
T-600	*25D65840A22	VERTICAL OUTPUT
T-800	*25D68164A01	POWER
RESISTORS		
R-127	17S135542	10K 10% 7W WW
R-516	17S132815	1.0 10% 2W WW (USE 17K561979)
R-516	17S739323	5.6 10% 2W WW
R-520	17S132786	33 10% 5W WW
R-617	6C66263A08	VARISTOR (vertical)
R-700	6C65884A07	THERMISTOR (on yoke)
R-802	17S745634	5 10% 5W WW
R-803	*17S135771	375 10% 10W WW
R-806A	6C66263A08	VARISTOR (power supply)
R-806B	6C66263A08	VARISTOR (power supply)
CONTROLS		
R-120	*18D66401A19	1ST VIDEO BIAS: 10K
R-130	*18D67502A07	CONTRAST: 1K
R-202	*18D67637A49	BRIGHTNESS: 100K
R-307	*18D68418A01	ON-OFF & VOLUME: 50K
R-405	*18D66401A20	RF AGC DELAY: 18K
R-408	*18D67678A03	VERT LIN: 4K, noise gate 750 ohms
R-602	*18D67637A50	VERTICAL HOLD: 3K
R-610	18D67678A03	VERT LIN: 4K, noise gate 750 ohms
R-616	*18D68447A01	VERT SIZE: 15 ohms WW
		MECHANICAL PARTS
	*1V68607A45	ANTENNA TERM BOARD ASSEM: incl screws, VHF-UHF
	*84V68607A29	BOARD, plated chassis: less components
	30V66545A28	CABLE, UHF coax: incl plugs
	1V66551A04	CABLE, VHF coax: incl plug & retainer
	42A742819	CLAMP, yoke cover
	*42C67981A04	CLIP, cap mtg (C-804)
	*42C67981A03	CLIP, cap mtg (C-806)
	42C66799A01	CLIP, plastic: cap ret (C-511)
	42C66732A05	CLIP, terminal: UHF antenna term
	42C66732A04	CLIP, terminal: VHF antenna term
	*42K753665	CLIP, wire: CRT fil lead dress
	42C65864A31	CONNECTOR, anode: incls wire (USE 42C65864A19)
	15S10183A04	CONNECTOR, plug: 3 cont; less contacts (from spkr)
	15S10183A03	CONNECTOR, receptacle: 3 cont; spkr cable from chassis (less contacts)
	39S10184A02	CONTACT, plug: spkr connector
	39S10184A01	CONTACT, receptacle: spkr connector
	76C66210A04	CORE, iron: T-501 (2 req'd)
	26A66745A01	HEAT SINK (video output Q-5)
	*14C68409A01	INSULATOR, coil position (used to position 3rd IF pri & sec)
	*14D68326A01	INSULATOR, HV socket cover
	14A63948A01	INSULATOR, transistor (Q-10)
	14A562353	INSULATOR, transistor (Q-18 & Q-24 USE 14A543810)
	9C66402A05	LUG, terminal: ant & yoke leads
	29S10134A11	LUG, terminal: blue CRT socket lead (USE 29D67429A04)
	29A64778A01	LUG, terminal (monopole gnd to chassis)
	*2S10054A35	NUT, clip-on: cab back mtg
	2S7051	NUT, hex: 3/8-32 control mtg
	28C66635A04	PLUG, AC line: interlock
	9C67349A02	RECEPTACLE, plug: 1 pin (IF input)
	47C66082A02	ROD, adjust: horiz hold
	*3S120082	SCREW, tpg: 8-18 x 3/8 (chassis mtg - 3 req'd - cab back mtg - 2 req'd)
	*3S135627	SCREW, tpg: 8-18 x 1/2 (cab back mtg - 3 req'd)
	9C65955A04	SOCKET, 9 pin: molded (V2)
	*9C67191A08	SOCKET, CRT
	9B63949A01	SOCKET, transistor (Q-10)
	*9C67532A01	SOCKET, transistor (Q-18 & Q-24)
	41A66225A03	SPRING, core clamp: T-501
	*41C65987A15	SPRING, gnd: CRT
		CABINET PARTS
	*85D67625A04	ANTENNA, UHF: "bow-tie"
	*75C66381A09	BUMPER, rubber: CRT mtg (8 req'd)
	*15E68204A01	CABINET BACK: plastic; walnut; less line cord
	*16P65145A81	CABINET FRONT: plastic; white; incls overlays
	*43B68314A01	COLLAR, monopole antenna
	30S183A07	CORD, AC line: incls ret clip (USE 30S183A09)
	*15D68208A01	COVER, handle: white
	50D67734A01	EARPHONE
	9C67498A04	JACK, earphone (USE 9P65145A04)
	*36D68062A06	KNOB, chan selector: UHF
	*1D68065A03	KNOB, chan selector: VHF
	*36D67685A09	KNOB, contrast, brightness, vertical hold
	*36D68317A01	KNOB, on-off-volume
	*34D68069A03	KNOB, UHF dial scale
	*36D68066A03	KNOB, VHF fine tuning
	2S134218	NUT, hex: 1/4-32 x 11/32 x 1/16 (earphone jack mtg)
	*13C68320A02	OVERLAY, control panel: UHF
	*13C68320A01	OVERLAY, control panel: VHF
	*42C67092A04	RETAINER, wire: CRT
	3S135383	SCREW, tpg: 6-18 x 3/8 (spkr mtg)
	3S132019	SCREW, tpg: 8-18 x 2-3/4 (CRT retainer)
	*1C68315A01	SLEEVE & SPRING ASSEM: monopole ant
	*50G10252A03	SPEAKER, 2 x 3-3/4 PM 8Ω VC
	2C65722A03	SPEEDNUT (CRT retainer)
	*41C68718A02	SPRING, grounding: CRT retainer
	*42B68323A01	STRAP, CRT mtg (4 req'd)
	1C68313A01	TUBE, ROD & BALL ASSEM: monopole ant
	*1V66589A57	WINDOW, dial light: incls term strip & clip

VHF TUNER - SCPTT-394

ELECTRICAL PARTS

CAPACITORS - NOTE: The capacitors in this list are recommended replacement types for the original equipment; all are ceramic disc type unless otherwise specified.

Ref. No.	Part Number	Description
C-1	*21S180D57	68 pf 5% 500V N470
C-2	21S180D57	68 pf 5% 500V N470
C-3	*21S180D58	3.6 pf ± .25 pf 500V N150
C-4	21S180A76	4.5 pf ± .25 pf 500V NPO
C-5	21S115956	1 pf 10% 500V fixed composition
C-6	*21S180D59	47 pf 10% 500V N470
C-7	21S132925	1000 pf feed-thru
C-8	*20P65146A18	TRIMMER, neutralizing
C-9	21S135870	1000 pf feed-thru 500V Z5U +100-0%
C-10	*21S180D60	10 pf ± .25 pf 500V NPO
C-11	*21S136135	18 pf 5% feed-thru 500V N470
C-12	21S115961	1.8 pf 10% 500V fixed composition
C-13	21S132925	1000 pf feed-thru
C-14	*21S136108	36 pf 5% feed-thru 500V N470
C-15	21S128576	6.8 pf ± .5 pf 5% 500V N150
C-16	*21S136110	100 pf 5% feed-thru N470
C-17	21S135870	1000 pf feed-thru Z5U +100-0% 500V
C-18	21S115950	2.7 pf 10% 500V fixed composition (USE 21P63022A02)
C-19	21S125698	10 pf ± .5 pf 500V N150
C-20	21S115959	1.5 pf 10% 500V fixed composition (USE 21R129763)
C-21	*21P65146A70	6.2 pf ± .25 pf 500V NPO
C-22	*21P65146A69	15 pf 3% 500V NPO
C-23	*21P65146A68	12 pf 5% 500V NPO
C-24	21P65146A69	15 pf 3% 500V NPO
C-25	21S135870	1000 pf feed-thru
C-26	21S132925	1000 pf feed-thru

MISCELLANEOUS ELECTRICAL PARTS

Ref. No.	Part Number	Description
E-1A	1P65121A40	OSCILLATOR ROTOR ASSEM: incls coils; less E-1B & E-1C
E-1B	*1P65146A01	PRE-SET SCREW ASSEM: incls gear head screws, spring & holder; less E-1A & E-1C
E-1C	47P65118A44	OSCILLATOR STATOR ASSEM: incls contacts; less E-1A & E-1B
E-2	*40P65146A02	MIXER WAFER ASSEM: incl L-20 thru L-25, & R-6
E-3	*40P65146A03	RF WAFER ASSEM: incl L-12 thru L-17 & R-4
E-4	*40P65146A04	SWITCH, UHF input: incl L-11, C-6
E-5	*40P65146A05	ANTENNA WAFER ASSEM: incls L-4 thru L-8
E-6	*40P65146A06	SWITCH, UHF B+ and dial light
E-7	*24P65146A07	ANTENNA INPUT FILTER ASSEM: incls C-1,C-2,L-1,L-2 & L-3

COILS

Ref. No.	Part Number	Description
L-3	*24P65146A08	BALUN COIL
L-10	24P65118A88	COIL, UHF input: shunt
L-11	24P65146A09	COIL, UHF input: series
L-18	24P65117A36	COIL, RF: channel 13
L-19	24P65114A20	COIL, MIXER: channel 13
L-26	*24P65146A10	COIL, IF output
L-39	*24P65146A11	COIL, master oscillator

TRANSISTORS

Ref. No.	Part Number	Description
Q-1	48P65146A61	RF AMP: Fairchild SE5020
Q-2	48P65146A62	MIXER: Fairchild SE5021
Q-3	48P65146A63	OSCILLATOR: Fairchild SE1010

MECHANICAL PARTS

Ref. No.	Part Number	Description
	*77D67941A03	VHF TUNER, SCPTT-394: complete
1	*44P65146A15	GEAR, nylon: 14 tooth; engages gear hd screws
2	*44P65146A16	GEAR, nylon: 10 tooth; idler gear
3	*1P65146A17	IDLER GEAR ASSEM: nylon; incls gears and drive link
4	2P65118A35	NUT, push on: osc rotor retainer
5	3P65145A82	SCREW, gear head: fine tuning
6	*47P65144A97	SHAFT, channel selector: incls detent wheel
7	*47P65144A98	SHAFT, fine tuning: incl gear & actuator clutch
8	42P65120A38	SPRING, retainer: fine tuning shaft ret
9	41P65120A42	SPRING, return: idler gear assem return
10	*41P65120A43	SPRING, bias: retains chan sel shaft on front plate
11	41P65120A39	SPRING, detent and shaft grounding

UHF TUNER - KTT-622

ELECTRICAL PARTS

CAPACITORS - NOTE: The capacitors in this list are recommended replacement types for the original equipment; capacitors with standard retma characteristics (i.e., Z5F) should be replaced with equivalent types. See retma characteristics chart in this manual. All are ceramic disc types unless otherwise specified.

Ref. No.	Part Number	Description
C-2	21P65112A69	24 pf 10% 500V
C-4	21S121275	3.3 pf ± .01 pf 500V (USE 21R124489)

RESISTORS - NOTE: All resistors are insulated composition type unless otherwise specified.

Ref. No.	Part Number	Description
R-1	6S128229	680,000 10% 1/2W
R-2	6S127800	220 10% 1/4W
R-3	6S129231	3300 10% 1/4W
R-4	6S119925	1200 10% 1/2W
R-5	6S125568	22,000 10% 1/2W

MISCELLANEOUS ELECTRICAL PARTS

Ref. No.	Part Number	Description
E-1	48P65112A73	DIODE, crystal (1N82A)

TRANSISTORS

Ref. No.	Part Number	Description
Q-1	48P65123A67	TRANSISTOR NPN SE-1044

MECHANICAL PARTS

Ref. No.	Part Number	Description
	77P65112A75	UHF TUNER, TT-622: incl disc clutch assem; less drive shaft assem and mtg bracket
	7P65112A74	BRACKET, drive assem mounting
	47P65144A07	DRIVE SHAFT ASSEMBLY: less mounting bracket

UHF TUNER - KTT-626

Ref. No.	Part Number	Description
C-1		TUNING GANG (not replaceable)
C-2	21P65144A76	24 pf feed-thru
C-3	21P65144A77	10 pf
C-4	21P65144A78	470 pf feed-thru
C-5	21P65144A79	100 pf feed-thru
E-1	48P65112A73	DIODE, mixer
L-2	24P65144A74	IF coil
L-4	24P65144A73	EMITTER COIL
Q-1	48P65144A72	TRANSISTOR (S1019)
	77D67691A05	UHF TUNER, KTT-626: complete

*DENOTES NEW ITEM APPEARING IN ANY LIST FOR FIRST TIME.

TRANSISTOR SPECIFICATIONS CHART

FUNCTION, TYPE & MOTOROLA NO.	MAXIMUM PWR DISS. (NOTE 9)	BV_{CEO}	H_{FE} (BETA - NOTE 12)	f_T
Vertical Output Silicon NPN 4900/A1C	100w @ 60°C	See Note 10	30-90 @ V_{CE} 5V I_C 300ma (See Note 11)	
Horiz. Output Silicon NPN 4901/A1D	Special application, use exact Motorola replacement type only.			
Video I.F. (Forward AGC) Silicon NPN 4904/A1G (Note #1)	210mw @ 60°C	40V @ I_C 2ma	40 min @ V_{CE} 10V I_C 4ma	45MC pwr gain 25 db min
1st 4.5MC amp Audio amp Silicon NPN 4918/A1L	210mw @ 60°C	40V @ I_C 1ma	100 min @ V_{CE} 10V I_C 1ma	
2nd 4.5MC amp Silicon NPN 2N3694/A2T	200mw @ 25°C	40V @ I_C 1ma	100-400 @ V_{CE} 10V I_C 10ma	200MC min @ V_{CE} 10V I_C 10ma
Horiz. Driver Silicon NPN 4919/A1M	1.2w @ 60°C	140V @ I_C 1ma	10 min @ V_{CE} .3V I_C 150ma	100MC min @ V_{CE} 20V I_C 20ma
Audio Output Silicon NPN 4920/A1N	7.5w @ 100°C	350V @ I_C 1ma	50-250 @ V_{CE} 10V I_C 50ma	15MC min @ V_{CE} 10V I_C 100ma
Video Output Silicon NPN 4927/A1S	.6w @ 60°C	325V @ I_C 1ma	20 min @ V_{CE} 20V I_C 30ma 15 min @ V_{CE} 10V I_C 10ma	50MC min @ V_{CE} 20V I_C 20ma
3rd I.F. Amp Silicon NPN 4932/A1U	210mw @ 60°C	40V @ I_C 1ma	20-100 @ V_{CE} 10V I_C 10ma	45MC pwr gain I_C 10ma 27 db min
AGC Amp, Vert OSC, Hor Pulse Shaper, AGC Delay Silicon PNP 4910/P1C	210mw @ 60°C	-40V @ I_C 1ma	50-200 @ V_{CE} 10V I_C 10ma	
1st Video amp Silicon NPN 4841	210mw @ 60°C	40V @ I_C 1ma	100-300 @ V_{CE} 10V I_C 10ma	200MC min @ V_{CE} 15V I_C 10ma
Noise Gate H. OSC Silicon NPN 4842	210mw @ 60°C	40V @ I_C 1ma	50-200 @ V_{CE} 10V I_C 10ma	
AGC Gate, Sync Sep, V Driver, Vert Pulse Inv. Silicon NPN 4933/A1V	210mw @ 60°C	40V @ I_C 1ma	200-400 @ V_{CE} 10V I_C 10ma	30 min @ V_{CE} 10V I_C 10ma
AFC Diode Silicon 4917/D1C	I_R=100 ua dc @ 60V DC	Trr=1.5 usec		
Damper & Pulse Limiter Diode Silicon 4921/D1D	I_R=10 ua dc @ 700V DC	V_F=1.1V @ 1 amp T_S=2 usec @ I_F=5A		

NOTES:

1. *Special application - Replace with exact Motorola replacement type only.
2. BV_{CEO} - Breakdown voltage, collector to emitter, base open.
3. H_{FE} - dc forward current transfer ratio (common emitter) Beta
4. f_T - Current gain-bandwidth product. Frequency at which beta equals 1.
5. V_F - Forward voltage drop.
6. I_R - Reverse current.
7. T_S - Turn on time.
8. T_{rr} - Recovery time.
9. Power dissipation derating factor:
   210mw @ 60°C units derate 2.8mw per °C rise over 60°C
   .6w @ 60°C units derate 5.3mw per °C rise over 60°C
   1.2w @ 60°C units derate 8.7mw per °C rise over 60°C
   7.5w @ 100°C units derate 100mw per °C rise over 100°C
10. Breakdown voltage (BV_{CER}) is measured with 1500 ohm resistor connected between emitter and base.

    BV_{CER}=500V I_C 2ma
11. Beta @ V_{CE} 5V I_C 400ma must be higher than beta @ V_{CE} 5V I_C 300ma.
12. Beta = ratio of change in collector current to change in base current (or gain of the transistor)

VHF TUNER - SCPTT-394

ELECTRICAL PARTS

CAPACITORS - NOTE: The capacitors in this list are recommended replacement types for the original equipment; all are ceramic disc type unless otherwise specified.

Ref. No.	Part Number	Description
C-1	*21S180D57	68 pf 5% 500V N470
C-2	21S180D57	68 pf 5% 500V N470
C-3	*21S180D58	3.6 pf ± .25 pf 500V N150
C-4	21S180A76	4.5 pf ± .25 pf 500V NPO
C-5	21S115956	1 pf 10% 500V fixed composition
C-6	*21S180D59	47 pf 10% 500V N470
C-7	21S132925	1000 pf feed-thru
C-8	*20P65146A18	TRIMMER, neutralizing
C-9	21S135870	1000 pf feed-thru 500V Z5U +100-0%
C-10	*21S180D60	10 pf ± .25 pf 500V NPO
C-11	*21S136135	18 pf 5% feed-thru 500V N470
C-12	21S115961	1.8 pf 10% 500V fixed composition
C-13	21S132925	1000 pf feed-thru
C-14	*21S136108	36 pf 5% feed-thru 500V N470
C-15	21S128576	6.8 pf ± .5 pf 5% 500V N150
C-16	*21S136110	100 pf 5% feed-thru N470
C-17	21S135870	1000 pf feed-thru Z5U +100-0% 500V
C-18	21S115950	2.7 pf 10% 500V fixed composition (USE 21P63022A02)
C-19	21S125698	10 pf ± .5 pf 500V N150
C-20	21S115959	1.5 pf 10% 500V fixed composition (USE 21R129763)
C-21	*21P65146A70	6.2 pf ± .25 pf 500V NPO
C-22	*21P65146A69	15 pf 3% 500V NPO
C-23	*21P65146A68	12 pf 5% 500V NPO
C-24	21P65146A69	15 pf 3% 500V NPO
C-25	21S135870	1000 pf feed-thru
C-26	21S132925	1000 pf feed-thru

MISCELLANEOUS ELECTRICAL PARTS

Ref. No.	Part Number	Description
E-1A	1P65121A40	OSCILLATOR ROTOR ASSEM: incls coils; less E-1B & E-1C
E-1B	*1P65146A01	PRE-SET SCREW ASSEM: incls gear head screws, spring & holder; less E-1A & E-1C
E-1C	47P65118A44	OSCILLATOR STATOR ASSEM: incls contacts; less E-1A & E-1B
E-2	*40P65146A02	MIXER WAFER ASSEM: incl L-20 thru L-25, & R-6
E-3	*40P65146A03	RF WAFER ASSEM: incl L-12 thru L-17 & R-4
E-4	*40P65146A04	SWITCH, UHF input: incl L-11, C-6
E-5	*40P65146A05	ANTENNA WAFER ASSEM: incls L-4 thru L-8
E-6	*40P65146A06	SWITCH, UHF B+ and dial light
E-7	*24P65146A07	ANTENNA INPUT FILTER ASSEM: incls C-1,C-2,L-1,L-2 & L-3

COILS

Ref. No.	Part Number	Description
L-3	*24P65146A08	BALUN COIL
L-10	24P65118A88	COIL, UHF input: shunt
L-11	24P65146A09	COIL, UHF input: series
L-18	24P65117A36	COIL, RF: channel 13
L-19	24P65114A20	COIL, MIXER: channel 13
L-26	*24P65146A10	COIL, IF output
L-39	*24P65146A11	COIL, master oscillator

TRANSISTORS

Ref. No.	Part Number	Description
Q-1	48P65146A61	RF AMP: Fairchild SE5020
Q-2	48P65146A62	MIXER: Fairchild SE5021
Q-3	48P65146A63	OSCILLATOR: Fairchild SE1010

MECHANICAL PARTS

Ref. No.	Part Number	Description
	*77D67941A03	VHF TUNER, SCPTT-394: complete
1	*44P65146A15	GEAR, nylon: 14 tooth; engages gear hd screws
2	*44P65146A16	GEAR, nylon: 10 tooth; idler gear
3	*1P65146A17	IDLER GEAR ASSEM: nylon; incls gears and drive link
4	2P65118A35	NUT, push on: osc rotor retainer
5	3P65145A82	SCREW, gear head: fine tuning
6	*47P65144A97	SHAFT, channel selector: incls detent wheel
7	*47P65144A98	SHAFT, fine tuning: incl gear & actuator clutch
8	42P65120A38	SPRING, retainer: fine tuning shaft ret
9	41P65120A42	SPRING, return: idler gear assem return
10	*41P65120A43	SPRING, bias: retains chan sel shaft on front plate
11	41P65120A39	SPRING, detent and shaft grounding

UHF TUNER - KTT-622

ELECTRICAL PARTS

CAPACITORS - NOTE: The capacitors in this list are recommended replacement types for the original equipment; capacitors with standard retma characteristics (i.e., Z5F) should be replaced with equivalent types. See retma characteristics chart in this manual. All are ceramic disc types unless otherwise specified.

Ref. No.	Part Number	Description
C-2	21P65112A69	24 pf 10% 500V
C-4	21S121275	3.3 pf ± .01 pf 500V (USE 21R124489)

RESISTORS - NOTE: All resistors are insulated composition type unless otherwise specified.

Ref. No.	Part Number	Description
R-1	6S128229	680,000 10% 1/2W
R-2	6S127800	220 10% 1/4W
R-3	6S129231	3300 10% 1/4W
R-4	6S119925	1200 10% 1/2W
R-5	6S125568	22,000 10% 1/2W

MISCELLANEOUS ELECTRICAL PARTS

Ref. No.	Part Number	Description
E-1	48P65112A73	DIODE, crystal (1N82A)

TRANSISTORS

Ref. No.	Part Number	Description
Q-1	48P65123A67	TRANSISTOR NPN SE-1044

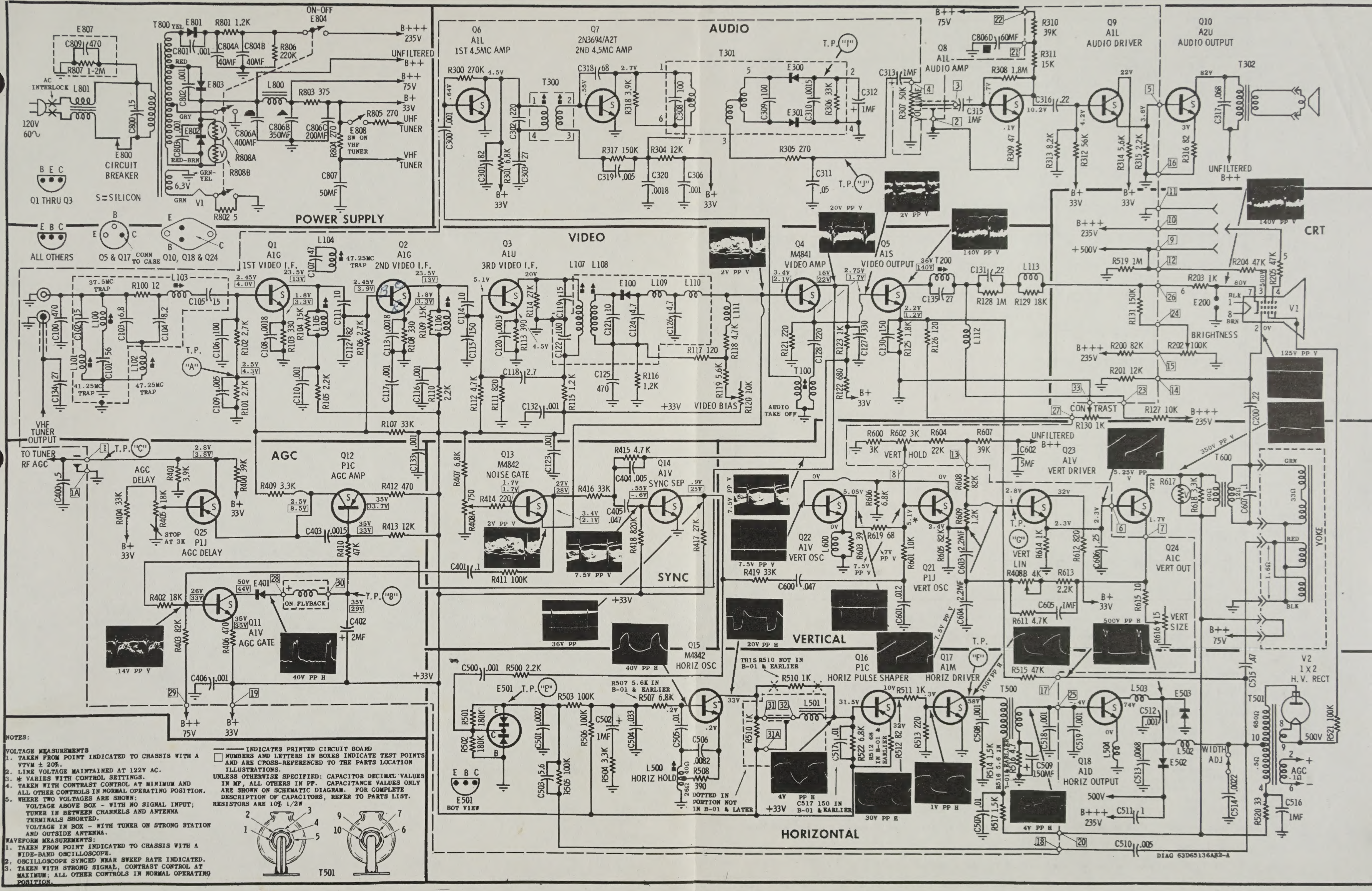
MECHANICAL PARTS

Ref. No.	Part Number	Description
	77P65112A75	UHF TUNER, TT-622: incl disc clutch assem; less drive shaft assem and mtg bracket
	7P65112A74	BRACKET, drive assem mounting
	47P65144A07	DRIVE SHAFT ASSEMBLY: less mounting bracket

UHF TUNER - KTT-626

Ref. No.	Part Number	Description
C-1		TUNING GANG (not replaceable)
C-2	21P65144A76	24 pf feed-thru
C-3	21P65144A77	10 pf
C-4	21P65144A78	470 pf feed-thru
C-5	21P65144A79	100 pf feed-thru
E-1	48P65112A73	DIODE, mixer
L-2	24P65144A74	IF coil
L-4	24P65144A73	EMITTER COIL
Q-1	48P65144A72	TRANSISTOR (S1019)
	77D67691A05	UHF TUNER, KTT-626: complete

*DENOTES NEW ITEM APPEARING IN ANY LIST FOR FIRST TIME.


POWER SUPPLY
AUDIO
VIDEO
AGC
SYNC
VERTICAL
HORIZONTAL
CRT
Q1 A1G 1ST VIDEO I.F.
Q2 A1G 2ND VIDEO I.F.
Q3 A1U 3RD VIDEO I.F.
Q4 M4841 VIDEO AMP
Q5 A1S VIDEO OUTPUT
Q6 A1L 1ST 4.5MC AMP
Q7 2N3694/A2T 2ND 4.5MC AMP
Q8 A1L AUDIO AMP
Q9 A1L AUDIO DRIVER
Q10 A2U AUDIO OUTPUT
Q11 A1V AGC GATE
Q12 P1C AGC AMP
Q13 M4842 NOISE GATE
Q14 A1V SYNC SEP
Q15 M4842 HORIZ OSC
Q16 P1C HORIZ PULSE SHAPER
Q17 A1M HORIZ DRIVER
Q18 A1D HORIZ OUTPUT
Q21 P1J VERT OSC
Q22 A1V VERT OSC
Q23 A1V VERT DRIVER
Q24 A1C VERT OUT
Q25 P1J AGC DELAY
V1
V2 1X2 H.V. RECT
VHF TUNER OUTPUT
TO TUNER RF AGC
120V 60~
E800 CIRCUIT BREAKER
Q1 THRU Q3
S=SILICON
ALL OTHERS
Q5 & Q17 CONN TO CASE
Q10, Q18 & Q24
E501 BOT VIEW
T501
YOKE
BRIGHTNESS
CONTRAST
VERT HOLD
VERT LIN
VERT SIZE
WIDTH ADJ
HORIZ HOLD
VOLUME
VIDEO BIAS
AUDIO TAKE OFF
DIAG 63D65136A82-A

NOTES:

VOLTAGE MEASUREMENTS
1. TAKEN FROM POINT INDICATED TO CHASSIS WITH A VTVM ± 20%.
2. LINE VOLTAGE MAINTAINED AT 122V AC.
3. ✱ VARIES WITH CONTROL SETTINGS.
4. TAKEN WITH CONTRAST CONTROL AT MINIMUM AND ALL OTHER CONTROLS IN NORMAL OPERATING POSITION.
5. WHERE TWO VOLTAGES ARE SHOWN:
   VOLTAGE ABOVE BOX - WITH NO SIGNAL INPUT; TUNER IN BETWEEN CHANNELS AND ANTENNA TERMINALS SHORTED.
   VOLTAGE IN BOX - WITH TUNER ON STRONG STATION AND OUTSIDE ANTENNA.

WAVEFORM MEASUREMENTS:
1. TAKEN FROM POINT INDICATED TO CHASSIS WITH A WIDE-BAND OSCILLOSCOPE.
2. OSCILLOSCOPE SYNCED NEAR SWEEP RATE INDICATED.
3. TAKEN WITH STRONG SIGNAL, CONTRAST CONTROL AT MAXIMUM; ALL OTHER CONTROLS IN NORMAL OPERATING POSITION.

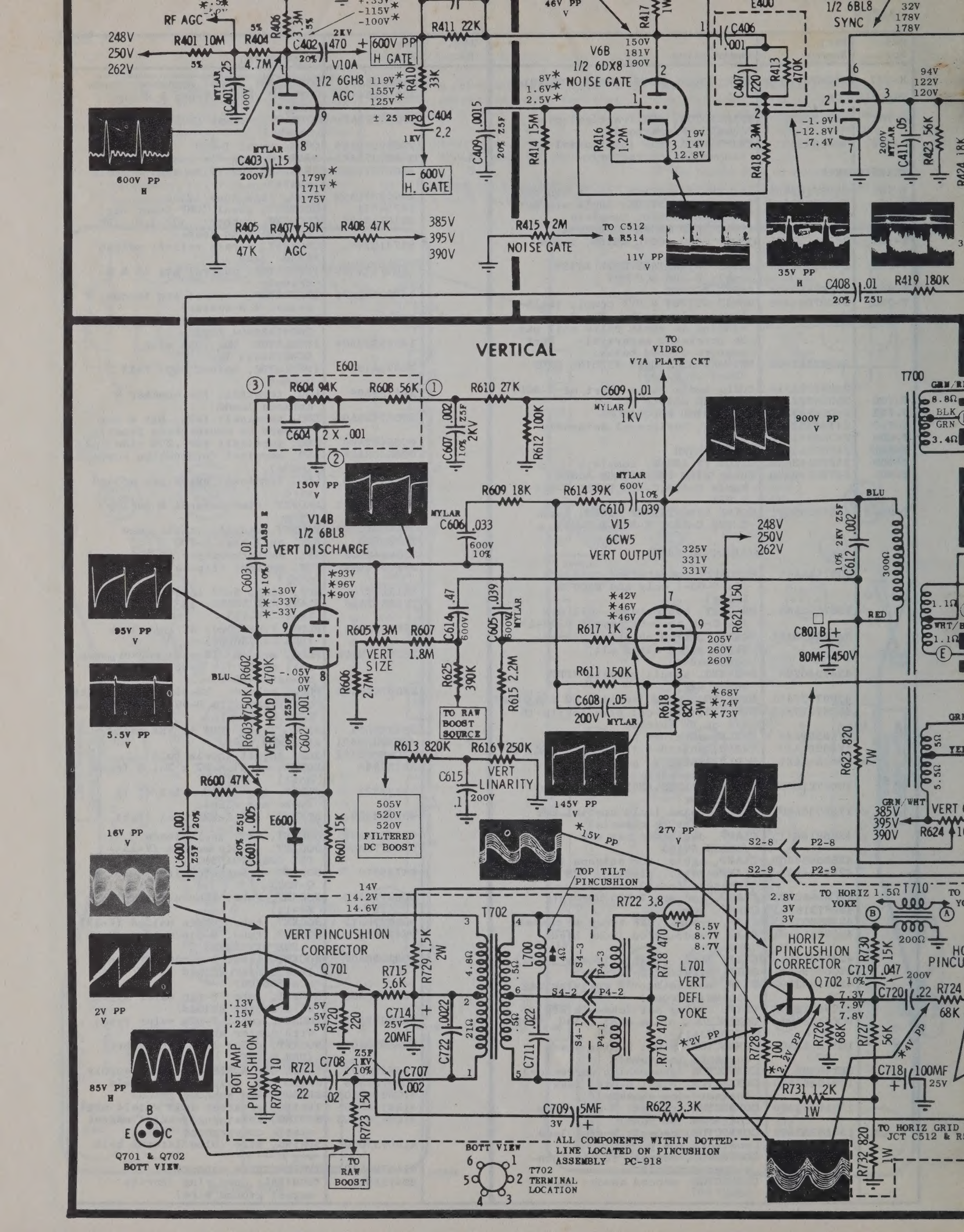
— — INDICATES PRINTED CIRCUIT BOARD

☐ NUMBERS AND LETTERS IN BOXES INDICATE TEST POINTS AND ARE CROSS-REFERENCED TO THE PARTS LOCATION ILLUSTRATIONS.

UNLESS OTHERWISE SPECIFIED: CAPACITOR DECIMAL VALUES IN MF, ALL OTHERS IN PF. CAPACITANCE VALUES ONLY ARE SHOWN ON SCHEMATIC DIAGRAM. FOR COMPLETE DESCRIPTION OF CAPACITORS, REFER TO PARTS LIST.

RESISTORS ARE 10% 1/2W

SCHEMATIC DIAGRAM - TS-458


RF AGC
248V
250V
262V
R401 10M
5%
R404 4.7M
R406 3.3M
C402 470 2KV 20%
600V PP H GATE
V10A 1/2 6GH8 AGC
119V* 155V* 125V*
R410 33K
C401 .25 MYLAR 400V
± .25 NPO C404 2.2 1KV
– 600V H. GATE
C403 .15 MYLAR 200V
179V* 171V* 175V
600V PP H
R405 47K
R407 50K AGC
R408 47K
385V 395V 390V
R411 22K
46V PP V
R417 1W
V6B 1/2 6DX8 NOISE GATE
150V 181V 190V
8V* 1.6V* 2.5V*
C409 .0015 20% Z5F
R414 15M
R416 1.2M
19V 14V 12.8V
R415 2M NOISE GATE
TO C512 & R514
11V PP V
E400
C406 .001
C407 220
R413 470K
R418 3.3M
1/2 6BL8 SYNC
32V 178V 178V
94V 122V 120V
-1.9V -12.8V -7.4V
C411 .05 200V MYLAR
R423 56K
R424 18K
35V PP H
C408 .01 20% Z5U
R419 180K
VERTICAL
E601
R604 94K
R608 56K
C604 2 X .001
R610 27K
C607 .002 10% Z5F 2KV
R612 100K
C609 .01 MYLAR 1KV
TO VIDEO V7A PLATE CKT
900V PP V
150V PP V
V14B 1/2 6BL8 VERT DISCHARGE
C603 .01 10% CLASS E
*-30V *-33V *-33V
*93V *96V *90V
95V PP V
R602 470K
BLU
R603 750K VERT HOLD
C602 .001 20% Z5F
-.05V 0V 0V
5.5V PP V
R605 3M VERT SIZE
R606 2.7M
R607 1.8M
C614 .47 600V
R625 390K
TO RAW BOOST SOURCE
C605 .039 600V MYLAR
R615 2.2M
C606 .033 MYLAR 600V 10%
R609 18K
R614 39K
C610 .039 MYLAR 600V 10%
V15 6CW5 VERT OUTPUT
325V 331V 331V
248V 250V 262V
*42V *46V *46V
R617 1K
205V 260V 260V
R621 150
C612 .002 10% 2KV Z5F
R611 150K
C608 .05 200V MYLAR
R618 820 3W
*68V *74V *73V
C801B 80MF 450V
T700
GRN/RED 8.8Ω BLK GRN 3.4Ω
BLU RED 300Ω
1.1Ω WHT/B 1.1Ω
R613 820K
R616 250K VERT LINEARITY
C615 .1 200V
145V PP V
27V PP V
R623 820 7W
GRN/WHT
5Ω 5.5Ω
385V 395V 390V
VERT
R624
R600 47K
C600 .001 20% Z5F
C601 .005 20% Z5U
E600
R601 15K
505V 520V 520V FILTERED DC BOOST
16V PP V
*15V PP
S2-8 P2-8
S2-9 P2-9
TOP TILT PINCUSHION
14V 14.2V 14.6V
VERT PINCUSHION CORRECTOR Q701
T702
R715 5.6K
R729 1.5K 2W
4.8Ω
C714 25V 20MF
C722 .0022
21Ω
.5Ω
L700 4Ω
C711 .022
S4-3 P4-3
S4-2 P4-2
S4-1 P4-1
R722 3.8
R718 470
R719 470
L701 VERT DEFL YOKE
8.5V 8.7V 8.7V
*2V PP
2V PP V
.13V .15V .24V
.5V .5V .5V
R720 220
BOT AMP PINCUSHION
R709 10
R721 22
C708 .02
Z5F 1KV 10%
C707 .002
R723 150
TO RAW BOOST
85V PP H
Q701 & Q702 BOTT VIEW
B E C
C709 5MF 3V
R622 3.3K
ALL COMPONENTS WITHIN DOTTED LINE LOCATED ON PINCUSHION ASSEMBLY PC-918
BOTT VIEW
T702 TERMINAL LOCATION
2.8V 3V 3V
TO HORIZ 1.5Ω YOKE
T710
200Ω
HORIZ PINCUSHION CORRECTOR Q702
R730 15K
C719 .047 10% 200V
C720 .22
R724 68K
7.3V 7.9V 7.8V
R726 68K
R727 56K
R728 100 2.2V PP
*4V PP
C718 100MF 25V
R731 1.2K 1W
TO HORIZ GRID JCT C512 & R
R732 820 1W

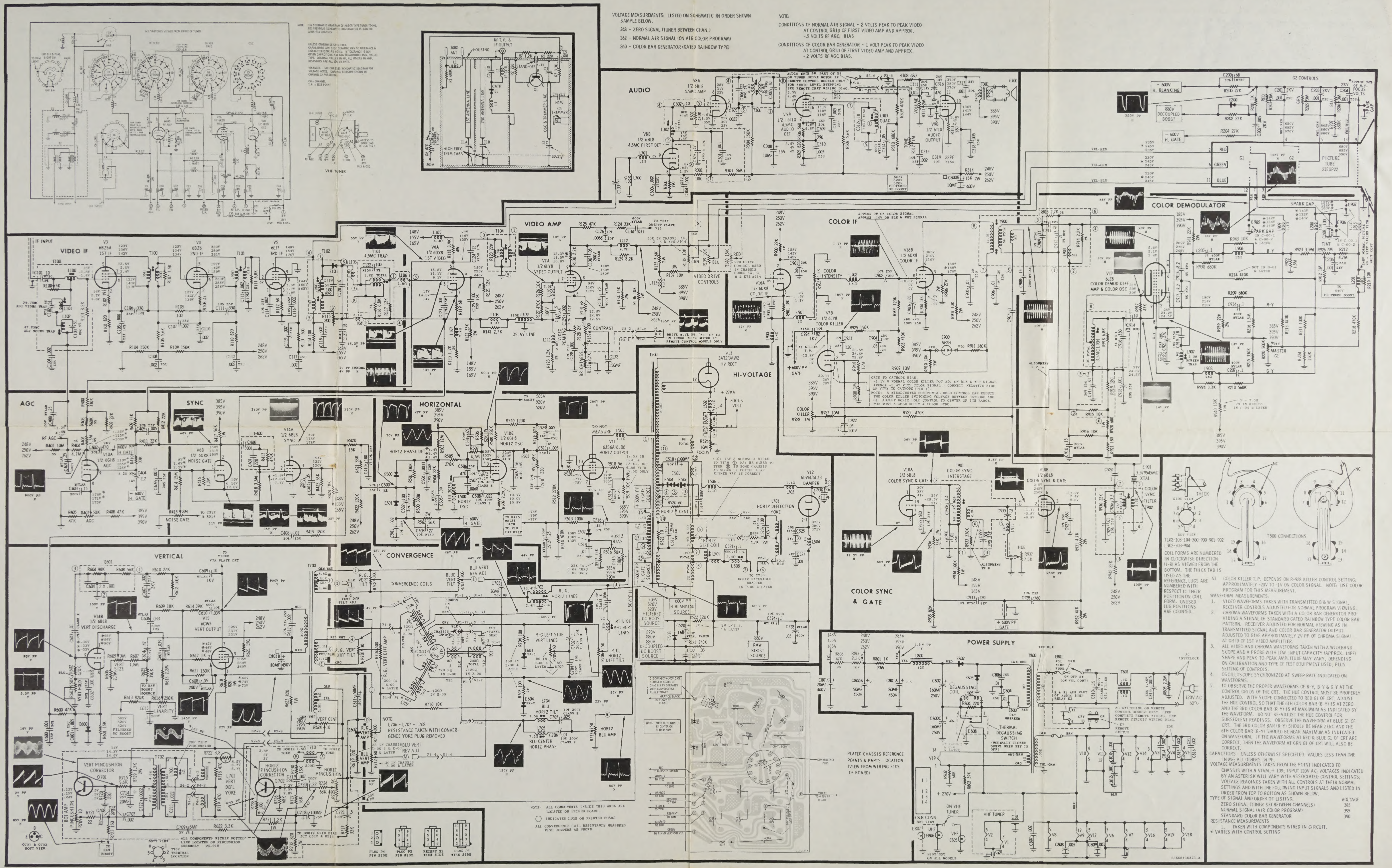
VOLTAGE MEASUREMENTS: LISTED ON SCHEMATIC IN ORDER SHOWN SAMPLE BELOW.

248 - ZERO SIGNAL (TUNER BETWEEN CHAN.)
262 - NORMAL AIR SIGNAL (ON AIR COLOR PROGRAM)
260 - COLOR BAR GENERATOR (GATED RAINBOW TYPE)

NOTE:

CONDITIONS OF NORMAL AIR SIGNAL - 2 VOLTS PEAK TO PEAK VIDEO AT CONTROL GRID OF FIRST VIDEO AMP AND APPROX. -.5 VOLTS RF AGC: BIAS

CONDITIONS OF COLOR BAR GENERATOR - 1 VOLT PEAK TO PEAK VIDEO AT CONTROL GRID OF FIRST VIDEO AMP AND APPROX. -.2 VOLTS RF AGC BIAS.


VHF TUNER
AUDIO
VIDEO IF
VIDEO AMP
COLOR IF
COLOR DEMODULATOR
AGC
SYNC
HORIZONTAL
HI-VOLTAGE
VERTICAL
CONVERGENCE
COLOR SYNC & GATE
POWER SUPPLY
PICTURE TUBE 23EGP22
T500 CONNECTIONS
SIDE VIEW
BOT VIEW
AC INTERLOCK
120V AC 60∿
PLATED CHASSIS REFERENCE POINTS & PARTS LOCATION (VIEW FROM WIRING SIDE OF BOARD)
PLUG P4 PIN SIDE
PLUG P2 PIN SIDE
RECEPT S2 WIRE SIDE
PLUG P3 WIRE SIDE
63E65136A73-A

T102-103-104-300-900-901-902
L302-303-904

COIL FORMS ARE NUMBERED IN CLOCKWISE DIRECTION (1-8) AS VIEWED FROM THE BOTTOM. THE THICK TAB IS USED AS THE REFERENCE. LUGS ARE NUMBERED WITH RESPECT TO THEIR POSITION ON COIL FORM. UNUSED LUG POSITIONS ARE COUNTED.

N1 COLOR KILLER T.P. DEPENDS ON R-928 KILLER CONTROL SETTING; APPROXIMATELY -20V TO -1V ON COLOR SIGNAL. NOTE: USE COLOR PROGRAM FOR THIS MEASUREMENT.

WAVEFORM MEASUREMENTS:

1. VIDEO WAVEFORMS TAKEN WITH TRANSMITTED B & W SIGNAL, RECEIVER CONTROLS ADJUSTED FOR NORMAL PROGRAM VIEWING.
2. CHROMA WAVEFORMS TAKEN WITH A COLOR BAR GENERATOR PROVIDING A SIGNAL OF STANDARD GATED RAINBOW TYPE COLOR BAR PATTERN. RECEIVER ADJUSTED FOR NORMAL VIEWING AS IN TRANSMITTED SIGNAL AND COLOR BAR GENERATOR OUTPUT ADJUSTED TO GIVE APPROXIMATELY 2V PP OF CHROMA SIGNAL AT GRID OF 1ST VIDEO AMPLIFIER.
3. ALL VIDEO AND CHROMA WAVEFORMS TAKEN WITH A WIDEBAND SCOPE AND A PROBE WITH LOW INPUT CAPACITY (APPROX. 14PF) SHAPE AND PEAK-TO-PEAK AMPLITUDE MAY VARY, DEPENDING ON CALIBRATION AND TYPE OF TEST EQUIPMENT USED, PLUS SETTING OF CONTROLS.
4. OSCILLOSCOPE SYCHRONIZED AT SWEEP RATE INDICATED ON WAVEFORMS.
5. TO OBSERVE THE PROPER WAVEFORMS OF R-Y, B-Y & G-Y AT THE CONTROL GRIDS OF THE CRT. THE HUE CONTROL MUST BE PROPERLY ADJUSTED. WITH SCOPE CONNECTED TO RED G1 OF CRT, ADJUST THE HUE CONTROL SO THAT THE 6TH COLOR BAR (B-Y) IS AT ZERO AND THE 3RD COLOR BAR (R-Y) IS AT MAXIMUM AS INDICATED BY THE WAVEFORM. DO NOT RE-ADJUST THE HUE CONTROL FOR SUBSEQUENT READINGS. OBSERVE THE WAVEFORM AT BLUE G1 OF CRT. THE 3RD COLOR BAR (R-Y) SHOULD BE NEAR ZERO AND THE 6TH COLOR BAR (B-Y) SHOULD BE NEAR MAXIMUM AS INDICATED ON WAVEFORM. IF THE WAVEFORMS AT RED & BLUE G1 OF CRT ARE CORRECT, THEN THE WAVEFORM AT GRN G1 OF CRT WILL ALSO BE CORRECT.

CAPACITORS - UNLESS OTHERWISE SPECIFIED. VALUES LESS THAN ONE IN MF; ALL OTHERS IN PF.

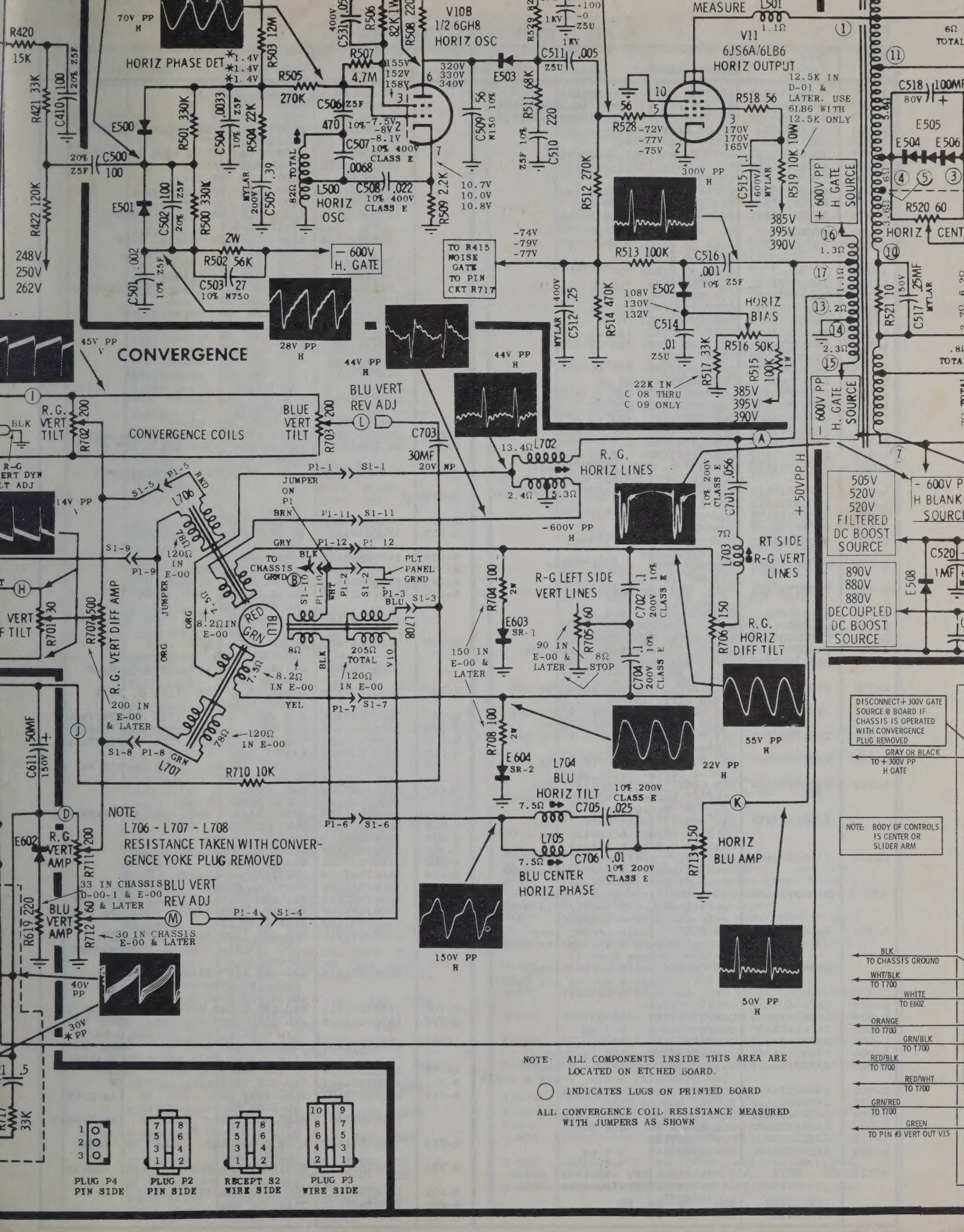
VOLTAGE MEASUREMENTS TAKEN FROM THE POINT INDICATED TO CHASSIS WITH A VTVM, + 10%; INPUT 120V AC; VOLTAGES INDICATED BY AN ASTERISK WILL VARY WITH ASSOCIATED CONTROL SETTINGS; VOLTAGE READINGS TAKEN WITH ALL CONTROLS AT THEIR NORMAL SETTINGS AND WITH THE FOLLOWING INPUT SIGNALS AND LISTED IN ORDER FROM TOP TO BOTTOM AS SHOWN BELOW.

TYPE OF SIGNAL AND ORDER OF LISTING.	VOLTAGE
ZERO SIGNAL (TUNER SET BETWEEN CHANNELS)	385
NORMAL SIGNAL (AIR COLOR PROGRAM)	395
STANDARD COLOR BAR GENERATOR	390

RESISTANCE MEASUREMENTS

1. TAKEN WITH COMPONENTS WIRED IN CIRCUIT.

* VARIES WITH CONTROL SETTING


CONVERGENCE
HORIZ PHASE DET
V10B
1/2 6GH8
HORIZ OSC
L500
HORIZ OSC
82Ω TOTAL
V11
6JS6A/6LB6
HORIZ OUTPUT
12.5K IN D-01 & LATER. USE 6LB6 WITH 12.5K ONLY
MEASURE
L501
1.1Ω
70V PP H
28V PP H
44V PP H
44V PP H
300V PP H
45V PP V
14V PP V
40V PP
30V PP
-600V PP H
55V PP H
22V PP H
150V PP H
50V PP H
R420 15K
R421 33K
R422 120K
C410 100
C500 100
C501 .002
C502 100
C503 27 10% N750
C504 .0033
C505 .39
C506 Z5F 470
C507 .0068 10% 400V CLASS E
C508 .022 10% 400V CLASS E
C509 56 N150 10%
C510 220
C511 .005
C512 .25 400V MYLAR
C514 .01 Z5U
C515 .1 600V MYLAR
C516 .001 10% Z5F
C517 25MF 50V MYLAR
C518 100MF 80V
C531 .05 400V
E500
E501
E502
E503
E504
E505
E506
E508
R500 330K
R501 330K
R502 56K 2W
R503 12M
R504 22K
R505 270K
R506 82K 1W
R507 4.7M
R508 220
R509 2.2K
R511 68K
R512 270K
R513 100K
R514 470K
R515 100K 1W
R516 50K
R517 33K
R518 56
R519 10K 10W
R520 60
R521 10
R528 56
R529 82
248V
250V
262V
155V
152V
158V
320V
330V
340V
-7.5V
-8V
-8.1V
10.7V
10.0V
10.8V
-72V
-77V
-75V
170V
170V
165V
-74V
-79V
-77V
108V
130V
132V
385V
395V
390V
385V
395V
390V
*1.4V
*1.4V
*1.4V
- 600V H. GATE
TO R415 NOISE GATE TO PIN CKT R717
HORIZ BIAS
22K IN C 08 THRU C 09 ONLY
+ 600V PP H GATE SOURCE
- 600V PP H. GATE SOURCE
- 600V PP H BLANK SOURCE
505V 520V 520V FILTERED DC BOOST SOURCE
890V 880V 880V DECOUPLED DC BOOST SOURCE
C520 1MF
HORIZ CENT
6Ω TOTAL
BLU VERT REV ADJ
BLUE VERT TILT R703 200
R.G. VERT TILT R702 200
CONVERGENCE COILS
C703 30MF 20V NP
L702 13.4Ω 2.4Ω 5.3Ω
R. G. HORIZ LINES
C701 .056 10% 200V CLASS E
+ 50VPP H
L703 7Ω
RT SIDE R-G VERT LINES
R-G LEFT SIDE VERT LINES
C702 .1 200V 10% CLASS E
C704 .1 200V 10% CLASS E
R705 60
90 IN E-00 & LATER
8Ω STOP
R704 100 2W
E603 SR-1
150 IN E-00 & LATER
R708 100 2W
E604 SR-2
R706 150
R.G. HORIZ DIFF TILT
L704 BLU HORIZ TILT
7.5Ω C705 .025 10% 200V CLASS E
L705 7.5Ω C706 .01 10% 200V CLASS E
BLU CENTER HORIZ PHASE
R713 150
HORIZ BLU AMP
R-G VERT DYN TILT ADJ
BLK
L706
L707
L708
RED
BRN
GRY
BLK
WHT
BLU
ORG
YEL
GRN
JUMPER ON P1
JUMPER
TO CHASSIS GRND
PLT PANEL GRND
P1-1 S1-1
P1-2 S1-2
P1-3 S1-3
P1-4 S1-4
P1-5 S1-5
P1-6 S1-6
P1-7 S1-7
P1-8 S1-8
P1-9 S1-9
P1-10 S1-10
P1-11 S1-11
P1-12 P1 12
120Ω IN E-00
78Ω
7.5Ω
8.2Ω IN E-00
8Ω
205Ω TOTAL
120Ω IN E-00
RED GRN BLU
R701 30
VERT DIFF TILT
R707 500
R.G. VERT DIFF AMP
200 IN E-00 & LATER
C611 50MF 150V
R710 10K
E602
R711 200
R.G VERT AMP
33 IN CHASSIS D-00-1 & E-00 & LATER
BLU VERT REV ADJ
R712 60
BLU VERT AMP
30 IN CHASSIS E-00 & LATER
R619 220
R717 33K
.5
DISCONNECT + 300V GATE SOURCE @ BOARD IF CHASSIS IS OPERATED WITH CONVERGENCE PLUG REMOVED
GRAY OR BLACK TO + 300V PP H GATE
NOTE: BODY OF CONTROLS IS CENTER OR SLIDER ARM
BLK TO CHASSIS GROUND
WHT/BLK TO T700
WHITE TO E602
ORANGE TO T700
GRN/BLK TO T700
RED/BLK TO T700
RED/WHT TO T700
GRN/RED TO T700
GREEN TO PIN #3 VERT OUT V15
PLUG P4 PIN SIDE
PLUG P2 PIN SIDE
RECEPT S2 WIRE SIDE
PLUG P3 WIRE SIDE

NOTE L706 - L707 - L708 RESISTANCE TAKEN WITH CONVERGENCE YOKE PLUG REMOVED

NOTE: ALL COMPONENTS INSIDE THIS AREA ARE LOCATED ON ETCHED BOARD.

○ INDICATES LUGS ON PRINTED BOARD

ALL CONVERGENCE COIL RESISTANCE MEASURED WITH JUMPERS AS SHOWN

MOTOROLA TV COLOR CHASSIS TS-918 SERIES

THIS SERVICE INFORMATION IS FOR THE USE OF QUALIFIED SERVICE PERSONNEL ONLY

INSTALLATION AND SERVICE ADJUSTMENTS

NOTE: DO NOT OPERATE CHASSIS WITH CONVERGENCE PLUG REMOVED FROM CONVERGENCE PANEL UNLESS THE +300V PP PULSE SOURCE HAS BEEN DISCONNECTED. SEE CONVERGENCE PANEL DETAIL ON SCHEMATIC DIAGRAM.

AUTOMATIC DEGAUSSER

This receiver is equipped with an automatic built-in degausser. It is a temperature controlled unit and is activated each time the receiver is turned on. The degaussing action takes place within the first 10 seconds after the receiver is turned on and before the picture comes on. The degaussing action cannot be seen. To degauss after the receiver has been on and has reached its maximum operating temperature, it will be necessary to turn the receiver off and allow it to cool for approximately 5 minutes. If the receiver has been on for only a few minutes, then the required cooling period is reduced.

Upon initial installation, we suggest you degauss the entire receiver and picture tube with a conventional portable degaussing coil.

FOCUSING ADJUSTMENT

Set brightness and contrast for normal picture. Then adjust focus control (located on chassis) for best overall focus, center to edge of screen.

DEFLECTION YOKE TILT ADJUSTMENT

Loosen the yoke retainer clamp and rotate yoke until picture is straight. Do not slide yoke forward or backwards on the neck of the tube as purity will be affected. Tighten the clamp screws when adjustment is completed.

PICTURE CENTERING

Vertical and horizontal centering controls are located on the rear of the chassis.

NOTE: Large control excursions will affect convergence.

COLOR KILLER

Tune in black and white picture. Starting with control in full clockwise position, when viewed from rear of receiver, turn control counter-clockwise slowly until color noise or snow disappears. Check all channels. If noise or snow remains on with a black and white picture, continue turning control counter-clockwise. Check setting when tuned to a color signal to make sure it was not over-adjusted on the black and white signal, thereby killing the color signal.

VERTICAL SIZE & LINEARITY

Both vertical size and linearity controls are located on the back of the chassis. Slight adjustments can be made with the vertical size control without affecting vertical linearity. Large control excursions should only be made prior to convergence.

HIGH VOLTAGE ADJUSTMENT

Reduce brightness control to minimum, full counter-clockwise (adjust master G-1, if necessary, to extinguish raster).

Measure the high voltage at the 2nd anode with an accurately calibrated 30KV voltmeter. Adjust horizontal bias control located at rear of chassis for 27KV 2nd anode voltage.

Alternate Method

Reduce brightness control to minimum, full counter-clockwise (adjust master G-1, if necessary, to extinguish raster).
With 120V AC line voltage, adjust horizontal bias control until 890V DC is measured at the raw boost terminal, see Figure A.

FINE TUNING ADJUSTMENT

This receiver employs a VHF tuner with a concentric pre-set fine tuning mechanism.

Rotating the fine tuning knob in either direction automatically engages the fine tuning mechanism and automatically disengages when knob is released.
To fine tune, rotate fine tuning knob in either direction for best picture and sound.

PINCUSHION ADJ. INSTRUCTIONS

VERTICAL: Adjust bottom amplitude control R-709 for minimum correction (maximum clockwise), then adjust top tilt coil L-700 for the straightest line possible near the top of screen.

Adjust R-709 for the straightest line possible near the bottom of the screen.

HORIZONTAL: Adjust horizontal control R-725 for optimum correction at left side of raster. Observe right side simultaneously, over correcting left side may cause barreling at right side of raster.

HORIZONTAL HOLD ADJUSTMENT (L-500)

Adjust the horizontal hold on the rear of the cabinet for most stable horizontal and color sync while switching from channel to channel.

AGC ADJUSTMENT

NOTE: AGC control is accurately adjusted at the factory. Avoid unnecessary adjustment.

To adjust, tune in a channel for best picture and sound. Turn the AGC control counter-clockwise (when viewed from rear of receiver) until the picture becomes unstable (rolls down or slips, etc). Then, turn control clockwise until the picture returns to normal. Check all channels; if any are unstable, continue turning control clockwise until the picture is normal on all channels.

VIDEO PEAKING CONTROL

The video peaking control should normally be set in maximum clockwise position for optimum video response. If high frequency background noise is visible on CRT, turn video peaking control counterclockwise to eliminate the background noise.

NOISE GATE CONTROL

The noise gate control is used to adjust the receiver for best hold stability under noise and different signal strength conditions.

To adjust, tune in a channel for best picture and sound. Turn the noise gate control clockwise (when viewed from rear of receiver) until the picture becomes unstable (rolls down or slips, etc.). Then turn control counter-clockwise until the picture just returns to normal. Check all channels; if any are unstable, continue turning control counter-clockwise until the picture is just normal on all channels.

TINT CONTROL

The tint control serves a dual purpose; on black and white, it is normally set to approximately the center of its range. On color programs, it is adjusted toward the right (clockwise) position for best flesh tones.

MOTOROLA TV COLOR CHASSIS TS-A914 SERIES

THIS SERVICE INFORMATION IS FOR THE USE OF QUALIFIED SERVICE PERSONNEL ONLY

INSTALLATION AND SERVICE ADJUSTMENTS

NOTE: DO NOT OPERATE CHASSIS WITH CONVERGENCE PLUG REMOVED FROM CONVERGENCE PANEL UNLESS THE +300V PP PULSE SOURCE HAS BEEN DISCONNECTED. SEE CONVERGENCE PANEL DETAIL ON SCHEMATIC DIAGRAM.

AUTOMATIC DEGAUSER

This receiver is equipped with an automatic built-in degausser. It is a temperature controlled unit and is activated each time the receiver is turned on. The degaussing action takes place within the first 10 seconds after the receiver is turned on and before the picture comes on. The degaussing action cannot be seen. To degauss after the receiver has been on and has reached its maximum operating temperature, it will be necessary to turn the receiver off and allow it to cool off approximately 5 minutes. If the receiver has been on for only a few minutes, then the required cooling period is reduced.

Upon initial installation, we suggest you degauss the entire receiver and picture tube with a conventional portable degaussing coil.

FOCUSING ADJUSTMENT

Set brightness and contrast for normal picture. Then adjust focus control (located on chassis) for best overall focus, center to edge of screen.

DEFLECTION YOKE TILT ADJUSTMENT

Loosen the yoke retainer clamp and rotate yoke until picture is straight. Do not slide yoke forward or backwards on the neck of the tube as purity will be affected. Tighten the clamp screws when adjustment is completed.

PICTURE CENTERING

Vertical and horizontal centering controls are located on the rear of the chassis.

NOTE: Large control excursions will affect convergence.

COLOR KILLER

Tune in black and white picture. Starting with control in full clockwise position, when viewed from rear of receiver, turn control counter-clockwise slowly until color noise or snow disappears. Check all channels. If noise or snow remains on with a black and white picture, continue turning control counter-clockwise. Check setting when tuned to a color signal to make sure it was not over-adjusted on the black and white signal, thereby killing the color signal.

VERTICAL SIZE & LINEARITY

Both vertical size and linearity controls are located on the back of the chassis. Slight adjustments can be made with the vertical size control without affecting vertical linearity. Large control excursions should only be made prior to convergence.

HIGH VOLTAGE ADJUSTMENT

Reduce brightness control to minimum, full counter-clockwise (adjust master G-1, if necessary, to extinquish raster).

Measure the high voltage at the 2nd anode with an accurately calibrated 30KV voltmeter. Adjust horizontal bias control located at rear of chassis for 27KV 2nd anode voltage.

Alternate Method

Reduce brightness control to minimum, full counter-clockwise (adjust master G-1, if necessary, to extinquish raster).

With 120V AC line voltage, adjust horizontal bias control until 890V DC is measured at the raw boost terminal, see Figure A.

FINE TUNING ADJUSTMENT

This receiver employs a VHF tuner with a concentric pre-set fine tuning mechanism.

Rotating the fine tuning knob in either direction automatically engages the fine tuning mechanism and automatically disengages when knob is released.

To fine tune, rotate fine tuning knob in either direction for best picture and sound.

PINCUSHION ADJ INSTRUCTIONS

VERTICAL: Adjust bottom amplitude control, R-709, for minimum correction (maximum clockwise), then adjust top tilt coil L-700 for the straightest line possible near the top of screen.

Adjust R-709 for the straightest line possible near the bottom of the screen.

HORIZONTAL: Adjust horizontal control, R-725, for optimum correction at left side of raster. Observe right side simultaneously, over correcting left side may cause barreling at right side of raster.

HORIZONTAL HOLD ADJUSTMENT (L-500)

Adjust the horizontal hold on the rear of the cabinet for most stable horizontal and color sync while switching from channel to channel.

AGC ADJUSTMENT

NOTE: AGC control is accurately adjusted at the factory. Avoid unnecessary adjustment.

To adjust, tune in a channel for best picture and sound. Turn the AGC control counter-clockwise (when viewed from rear of receiver) until the picture becomes unstable (rolls down or slips, etc.). Then, turn control clockwise until the picture returns to normal. Check all channels; if any are unstable, continue turning control clockwise until the picture is normal on all channels.

VIDEO PEAKING CONTROL

The video peaking control should normally be set in maximum clockwise position for optimum video response. If high frequency background noise is visible on CRT, turn video peaking control counter-clockwise to eliminate the background noise.

NOISE GATE CONTROL

The noise gate control is used to adjust the receiver for best hold stability under noise and different signal strength conditions.

To adjust, tune in a channel for best picture and sound. Turn the noise gate control clockwise (when viewed from rear of receiver) until the picture becomes unstable (rolls down or slips, etc.). Then turn control counter-clockwise until the picture just returns to normal. Check all channels, if any are unstable, continue turning control counter-clockwise until the picture is just normal on all channels.

TINT CONTROL

The tint control serves a dual purpose; on black and white, it is normally set to approximately the center of its range. On color programs, it is adjusted toward the right (clockwise) position for best flesh tones.

CONVERGENCE PROCEDURE

GENERAL CONVERGENCE PROCEDURE

The following eight steps outline, in general, the complete step by step convergence procedure that follows:

1. Demagnetize shadow mask with degaussing coil.

2. DC converge all three colors in center area of screen.

3. Adjust purity ring for center screen area red, adjust yoke position for outer area red.

4. Set tint control to its mechanical center and set black and white brightness tracking.

5. Properly center and size picture.

6. Dynamically converge all three colors.

7. Re-check Steps #2 and #3.

8. Repeat Step #4.

PURITY & CONVERGENCE PROCEDURE

PRELIMINARY PURITY ADJUSTMENTS

1. Connect crosshatch generator to antenna terminals and fine tune for best picture. Set brightness and contrast to normal.

2. Remove back cover to gain access to the convergence controls. Remove the 1/4" hex head screws securing convergence panel to chassis. The convergence panel may be rotated to a position along side the cabinet. Use one screw to secure convergence panel in this position.

3. Check adjustment of vertical size and linearity, vertical centering, horizontal centering, center of screen focus and then adjust controls if necessary to obtain a pattern of proper focus, size and location (see Figure #3).

4. Demagnetize receiver (use degaussing coil around front and all sides of CRT).

5. Turn color intensity control to minimum. Adjust red and green disc magnets for super-imposed red and green pattern at the center of the screen (see Figure #1).

6. Adjust blue disc magnet and blue lateral magnet to place the blue pattern on top of the red and green patterns (see Figure #1).

These preliminary adjustments are necessary to have the three beams in their approximate positions before purity is adjusted.

PURITY

1. Tune receiver to a blank channel or crosshatch generator pattern having a white background. A white noise free raster can be obtained by setting tuner between channels.

2. Set contrast to minimum, brightness to normal level and tint control to its mechanical center (see Figure #2).

3. Turn blue and green G-2 controls to minimum and red G-2 to maximum (see Figure #2).

4. Move yoke as far back as possible without hitting the convergence yoke.

5. Starting with the colored or same shaped tabs on the purity ring together (see Figure #4), spread them slowly and rotate the purity ring as a unit to place the red area at the center of screen.

6. Slide yoke forward and position for best overall red field. Usually it is not necessary to slide yoke against the CRT bell.

7. Level deflection yoke and tighten yoke clamps.

8. Check the purity of the blue and green fields by turning down the red G-2 and turning up the blue and green G-2 controls in turn. Normally, when red field purity is obtained the green and blue fields are also pure. If either of the fields show impurity, adjust purity ring and/or yoke and then recheck the other two fields.

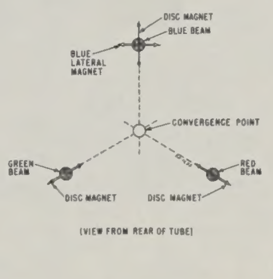


FIGURE 1. STATIC CONVERGENCE

PRELIMINARY CONVERGENCE & BACKGROUND ADJUSTMENTS

When adjusting the set-up controls, the G-2 controls are adjusted to make the three beams extinquish at the same time (white raster at low brightness). The video drive controls are adjusted for a white raster at high brightness levels. The CRT should then remain white between these two extreme brightness settings.

NOTE: The tint control should change the white raster from red to white to blue.

At high brightness levels, where the drive controls are adjusted, it is difficult to see a loss of red. The drive controls should be adjusted first until red is clearly visible and then alternately advanced until the screen is a warm white.

1. Set blue and green drive controls to mid-position and set tint control to mid-position (see Figure #3).

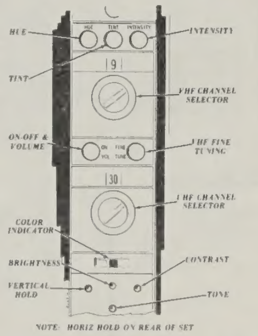
2. Set master G-1 control to minimum.

3. Tune receiver to a blank channel and set contrast to minimum.

4. Adjust all G-2 controls to maximum (fully right).

5. Adjust BRIGHTNESS control until the raster is just visible (adjust master G-1 if necessary to see raster).

6. Observe color of raster and reduce the G-2 controls of the predominent colors. The G-2 control for the weakest color should be left at maximum, then bring other controls up to produce a gray raster.



NOTE: HORIZ HOLD ON REAR OF SET

FIGURE 2. CONTROL PANEL

7. Advance BRIGHTNESS control to maximum (clockwise) and contrast control to minimum (counter-clockwise). Set tuner between channels.

8. Set line voltage at 120V AC. Measure voltage at boost terminal, Figure A. Starting with master G-1 at minimum (counter-clockwise), adjust master G-1 for a 40 volt DC drop in boost.

Alternate Method

Set BRIGHTNESS control to maximum (clockwise) position and contrast control to minimum (counter-clockwise) position.

Starting with the master G-1 control in its maximum counter-clockwise position, slowly rotate the master G-1 control until the picture just STARTS to go out of focus. Then turn the control back approximately 45°.

9. Reduce BRIGHTNESS control to normal brightness and check color of screen. If screen is white or gray (with tint control in its mid-position), set-up procedure is completed. If any color is dominant, proceed with Step #10.

10. Touch-up video drive controls, if necessary, to produce a warm white raster.

11. Reduce BRIGHTNESS to gray raster and touch-up G-2 controls, if necessary.

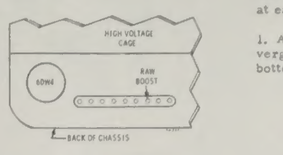


FIGURE A. RAW BOOST LOCATION

A. STATIC CONVERGENCE

1. Tune receiver to a white crosshatch and adjust for best picture.

2. Re-check center of screen focus, picture size, linearity and centering; correct if necessary.

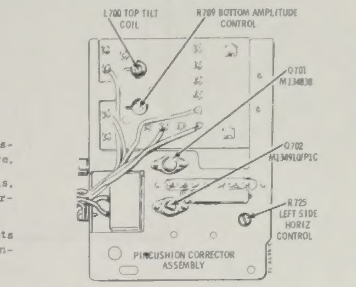
3. Adjust the three disc magnets and the blue lateral magnet for convergence of all three beams at the center of the screen (see Figure #4).

B. DYNAMIC CONVERGENCE

Vertical Dynamics

Obtain a red-green raster by turning blue G-2 to minimum. Use Figure #5, the convergence panel diagram, and observe the effect as illustrated at each control.

1. Adjust R-G vertical amp to converge the center vertical line at bottom of screen (Step #1).


L700 TOP TILT COIL
R709 BOTTOM AMPLITUDE CONTROL
Q701 M134838
Q702 M134910/P1C
R725 LEFT SIDE HORIZ CONTROL
PINCUSHION CORRECTOR ASSEMBLY

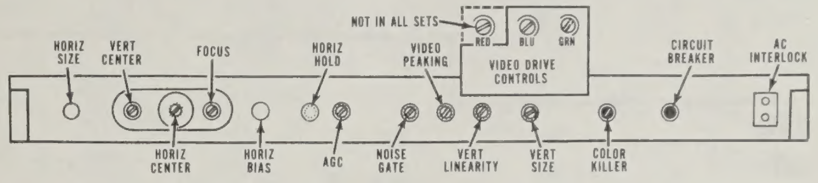


FIGURE 3. REAR VIEW OF CHASSIS

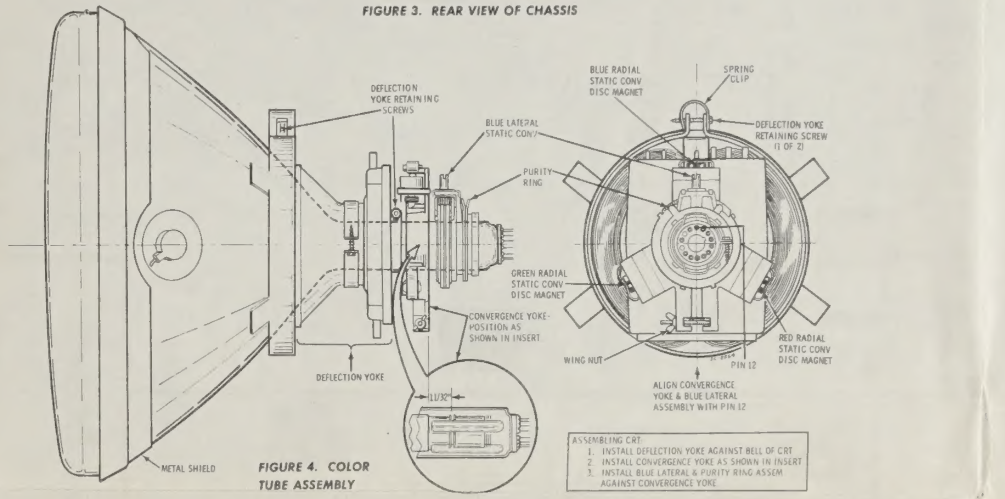

DEFLECTION YOKE RETAINING SCREWS
BLUE LATERAL STATIC CONV
PURITY RING
SPRING CLIP
BLUE RADIAL STATIC CONV DISC MAGNET
DEFLECTION YOKE RETAINING SCREW
GREEN RADIAL STATIC CONV DISC MAGNET
CONVERGENCE YOKE POSITION AS SHOWN IN INSERT
DEFLECTION YOKE
WING NUT
PIN 12
RED RADIAL STATIC CONV DISC MAGNET
ALIGN CONVERGENCE YOKE & BLUE LATERAL ASSEMBLY WITH PIN 12
METAL SHIELD

FIGURE 4. COLOR TUBE ASSEMBLY

ASSEMBLING CRT:
1. INSTALL DEFLECTION YOKE AGAINST BELL OF CRT
2. INSTALL CONVERGENCE YOKE AS SHOWN IN INSERT
3. INSTALL BLUE LATERAL & PURITY RING ASSEM AGAINST CONVERGENCE YOKE

2. Adjust R-G vertical tilt to converge the center vertical line at top of screen (Step #2).

NOTE: If the range of the R-G vertical amp and tilt controls is inadequate, move the black wire jumper to its opposite position as indicated on the legened side of convergence panel.

Alternately repeat Steps #1 and #2 for best convergence at top and bottom of center vertical line. Best convergence is obtained by superimposing the lines from the center outward. However, the proper adjustment of these controls may result in the red and green lines being parallel. If this condition exists, converge the lines by using the disc magnets.

3. Adjust the R-G vertical differential amp control to converge a horizontal line near the bottom of the screen (Step #3).

4. Adjust the R-G vertical differential tilt to converge a horizontal line near the top of the screen (Step #4).

If the horizontal lines in the center of the screen are misconverged, repeat Steps #3 and #4 for equally spaced horizontal lines from top to bottom of screen. Re-adjust disc magnets if necessary. Re-adjust the R-G vertical amp and tilt controls (Steps #1 and #2) for center vertical lines, if necessary.

5. Turn up the blue G-2 control and reduce the blue vertical amp to minimum (Step #5).

6. Adjust the blue vertical tilt control to produce equal displacement in the same direction of the blue horizontal lines with respect to red and green from the top to bottom of screen (Step #6).

Adjust the blue vertical amp to produce displacement in the same direction of the blue horizontal lines at the top, center and bottom of the screen (Step #5).

NOTE: If the range of the blue vertical amp and tilt controls is inadequate, reverse the positioning of the brown and blue jumpers as indicated on the legened side of convergence panel.

Alternately repeat Step #5 and Step #6 for satisfactory convergence of the blue horizontal lines from top to bottom of screen along the center of screen, or for equal displacement to permit convergence with the disc magnets.

Horizontal Dynamics

Turn off the blue G-2 leaving the red and green fields on the screen.

7. Adjust the right-side R-G vertical line control to make the vertical lines from the center to the right side converge (Step #7).

8. Adjust the left-side R-G vertical line control to make the vertical lines from the center to the left side converge (Step #8).

Re-touch the right and left R-G vertical line controls for best overall convergence of the vertical lines or for an error that lends itself to correction by the disc magnets.

9. Adjust the R-G horizontal lines control to make the horizontal red and green lines converge or symmetrical at the right and left side of screen (Step #9).

Repeat Steps #7, #8 and #9 for best overall convergence, or for equal spacing of lines which can be corrected with the disc magnets.

10. Adjust the R-G horizontal differential tilt control to make the center horizontal line converged or for equal displacement to permit convergence with the disc magnets.

11. Turn up the blue G-2 control. The blue horizontal amp control which is also used in Step #14 must first be adjusted to maximum clockwise rotation (Step #11).

12. Adjust the blue horizontal tilt control until the droop in the blue line is in the center of the screen (Step #12).

13. Adjust the blue horizontal phase until the droop in the blue line is forced upward (Step #13).

14. Re-adjust blue horizontal amp control until blue line is converged on R-G line along a center horizontal line or for equal displacement to permit convergence with the disc magnets (Step #14).

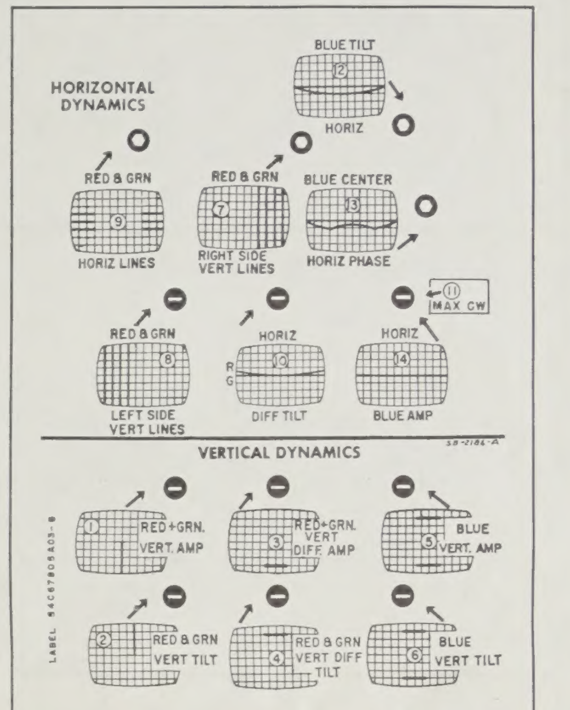


FIGURE 5. CONVERGENCE PANEL - FRONT VIEW

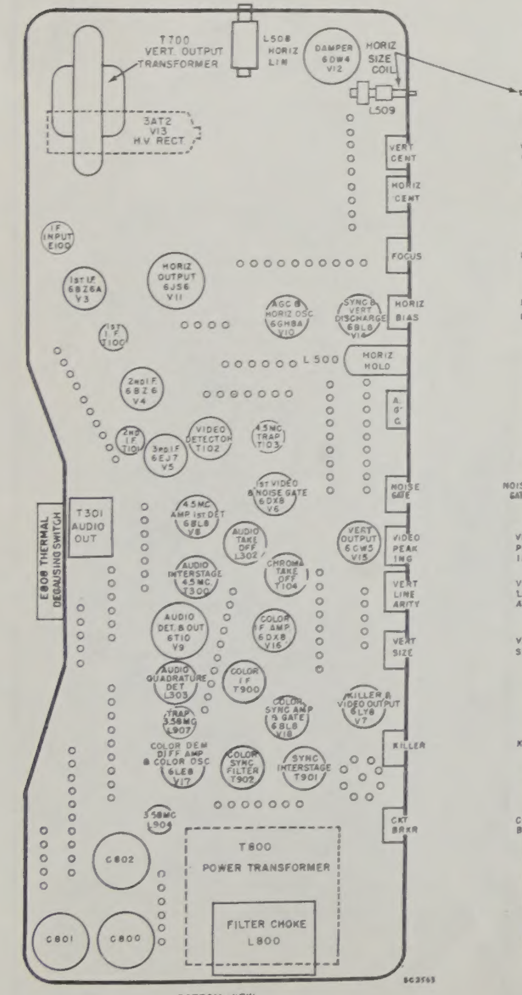
NOTE: If the displacement of the blue line is not equal on both ends with respect to R-G line, readjust blue horizontal tilt control (Step #12).

Repeat Steps #12, #13 and #14, if necessary, to get a satisfactory convergence along a center horizontal line or to get equal displacement to permit correction with the disc magnets.

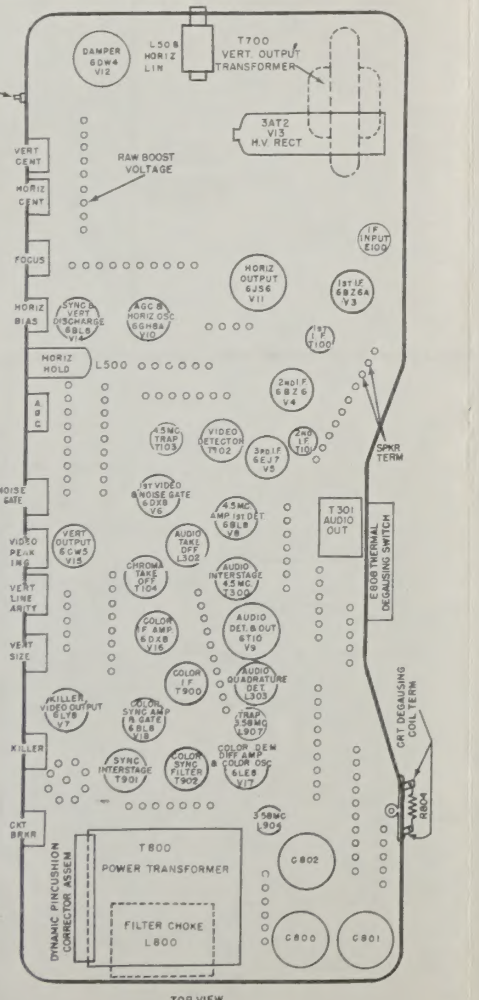
15. Re-check disc magnets. The pattern should now be converged.

The G-2 controls should now be reset for a white background. Generally, since the blue G-2 is the only one disturbed, it is possible to set this control at its proper adjustment at low brightness while observing a local station.

If the purity ring is re-adjusted for any reason, the entire convergence procedure must be repeated.



BOTTOM VIEW



TOP VIEW

REPLACEMENT PARTS LIST

Ref. No.	Part Number	Description
		ELECTRICAL PARTS
CAPACITORS		NOTE: The capacitors in this list are recommended replacement types for the original equipment; all are ceramic disc type unless otherwise specified.
	21S115956	1.0 pf 10% 500V fixed comp
	21S132473	2.2 pf +.25 1KV NPO
	21S120539	22 pf 10% 500V N150
	21S180B23	27 pf 10% 500V N750 (USE 21S122050)
	21S119912	33 pf 10% 500V N150
	21S180B31	33 pf 10% 2KV N150
	21S180A27	39 pf 5% 500V NPO
	21S121468	39 pf 10% 500V N750 (USE 21R122051)
	21S180B76	47 pf 10% N1500 6KV
	21S135380	51 pf 5% 500V NPO
	21S124472	56 pf 10% 500V N150
	21S180A95	68 pf 5% 500V NPO
	21S129652	68 pf 10% 500V N750
	21S128698	82 pf 10% 500V N750
	21P65133A34	100 pf 5% 3KV N1500 spcl corona free (USE 21K120543)
	21S180A98	100 pf 10% 500V Z5F (USE 21S132462)
	21S125723	100 pf 20% 500V Z5F (USE 21R410036)
	21S180B21	120 pf 10% 1KV N150
	21S180B38	120 pf 10% N1500
	21S180B26	150 pf 10% 500V N1500
	21S121698	220 pf 10% 500V Z5F (USE 21R132503)
	21S127090	330 pf 10% 500V Z5F
	21S132260	390 pf 20% 500V Z5F
	21S180B33	470 pf 20% 1KV Z5F
	21S121478	470 pf 20% 2KV Z5U
	21S131336	560 pf 10% 500V Z5F
	21S129510	680 pf 10% 500V Z5F (USE 21K752395)
	21S410124	680 pf 20% 500V Z5F (USE 21K752395)
	21K749722	800 pf 10% 500V X5F spcl (USE 21K124802)
	21S124802	800 pf 10% 500V Z5F
	21S128045	.001 mf 10% 500V Z5F
	21S124456	.001 mf 20% 2KV Z5U (USE 21R128242)
	21S129560	.001 mf 20% 1KV Z5F (USE 21K751859)
	21S410127	.001 mf 20% 500V Z5F (USE 21A121678)
	21S132293	.001 mf +100-0% 500V Z5U
	21S124541	.001 mf +100-0% 2KV Z5U
	21S131816	.0015 mf 20% 500V Z5F
	21S132419	.0015 mf +100-0% 1.4KV Z5U
	21S121836	.002 mf 10% 500V Z5F
	21S180A53	.002 mf +100-0% 500V Z5U
	21S125899	.002 mf 10% 2KV Z5F
	21S180A15	.0022 mf 10% 500V Z5F
	21S180B29	.0022 mf 10% 500V X5F (USE 21R129878)
	21S121882	.0022 mf 20% 500V Z5F
	21S121699	.0027 mf 10% 500V Z5F
	21S127855	.0033 mf 10% 500V Z5F (USE 21K746523)
	21S122871	.005 mf 20% 500V Z5U (USE 21R128634)
	21S115312	.005 mf +100-0% 500V Z5U
	21S124738	.005 mf +100-0% 1KV Z5U
	21S122871	.005 mf 20% 500V Z5U (USE 21R128634)
	21S180A45	.005 mf 20% 500V Z5F (USE 21R128634)
	21S131333	.0068 mf 10% 500V Z5F
	8S10072A23	.01 mf 10% 200V mylar (class "E" - USE 8S10072A20)
	8S10072A20	.01 mf 10% 400V mylar (class "E")
	21S121946	.01 mf 20% 500V Z5U (USE 21K751089)
	21S132007	.01 mf 20% 500V Z5U (USE 21R121994)
	21S122789	.01 mf 20% 1KV Z5U (USE 21R124832)
	21S131994	.01 mf +80-20% 500V Z5U
	21S482726	.01 mf +100-0% 500V Z5U
	8S10064A78	.01 mf 20% 1KV mylar
	8S10064C09	.015 mf 20% 200V mylar
	21S132000	.02 mf 20% 500V Z5U
	21S180B34	.02 mf 10% 1KV Z5F
	8S10072A06	.022 mf 10% 400V mylar
	8S10072A24	.025 mf 10% 200V mylar (class "E")
	8S10064A85	.033 mf 10% 600V mylar
	8S10064E12	.033 mf 20% 600V mylar (USE 8R10110A04)
	8S10064E13	.039 mf 20% 600V mylar (USE 8R10110A05)
	8S10064B27	.047 mf 10% 200V mylar
	8S10064E14	.047 mf 20% 600V mylar
	8S10064C15	.05 mf 20% 200V mylar (class "E" - USE 8R10064D15)
	8S10064E15	.05 mf 20% 600V mylar (USE 8R10064A46)
	21S180A57	.05 mf +80-20% 100V Z5U (USE 21S132524)
	8S10072A21	.056 mf 10% 200V mylar (USE 8S10072A01)
	8S10072A22	.1 mf 10% 200V mylar (class "E" - USE 8S10072A03)
	8S10064A02	.1 mf 20% 400V mylar (USE 8R10064D17)
	8S10064D17	.1 mf 20% 400V mylar
	8S10064A82	.1 mf 10% 600V mylar
	8S10064E17	.1 mf 20% 600V mylar (USE 8R10064A45)
	8S10064C18	.15 mf 20% 200V mylar (USE 8R10064D18)
	21S134271	.15 mf 20% 400V impreg paper
	8S10064B28	.22 mf 20% 200V mylar (USE 8S10064A12)
	8S10064A24	.25 mf 20% 50V mylar
	8S10064A83	.25 mf 20% 400V mylar (radial leads - USE 8S10064A67)
	8S10064A19	.25 mf 20% 400V mylar (axial leads - USE 8R10064A67)
	8S134393	.25 mf 20% 600V impreg paper
	8S10064A84	.39 mf 20% 200V mylar
	8C67728A08	.47 mf 20% 600V special
	8S10064A03	.5 mf 20% 100V mylar (USE 8R10064B23)
	8S10064A69	.5 mf 20% 200V mylar
	8C67728A02	1.0 mf 20% 600V tub spcl
	8C67779A01	2 mf 20% 600V paper oil filled (D23TS-A914)
	23D65282A34	5 mf 3V lytic
	23C65808A22	10 mf/25V lytic
	23D65828A35	20 mf 25V lytic
	23D65282A23	30 mf/20V lytic
	23C65808A08	50 mf/150V lytic
	23C67753A03	50 mf/450V; 10 mf/400V; 160 mf/250V lytic
	23C67753A01	80 mf/450V; 80 mf/450V; 20 mf/400V lytic
	23D65282A39	100 mf +100-0% 25V lytic
	23C65808A13	150 mf/25V lytic (USE 23C60119A15)
	23C67753A02	160 mf/250V lytic (USE 23C65807A07)
MISCELLANEOUS ELECTRICAL PARTS		
E-100	24V66550A32	IF INPUT ASSEMBLY: complete
E-101	48C65837A02	DIODE, crystal (Erie ED1891)
E-200	48D67120A08	DIODE, low power (Motorola SR76)
E-400	51D65239A21	RES-CAP, clipper
E-500	48D67120A02	DIODE, low power (Transitron SG3272)
E-501	48D67120A02	DIODE, low power (Transitron SG3272)
E-502	48D67120A07	DIODE, low power (Solitron CER500)
E-503	48D67120A06	DIODE, low power (Transitron SG3400)
E-504	48C67926A01	RECTIFIER, silicon (Solitron CER500)
E-505	48C67926A01	RECTIFIER, silicon (Solitron CER500)
E-506	48C67926A01	RECTIFIER, silicon (Solitron CER500)
E-508	48S191A06	RECTIFIER, silicon
E-600	48C65837A02	DIODE, crystal (Erie ED1891)
E-601	51D65239A22	RES-CAP, integrator
E-602	48S10062A01	RECTIFIER, silicon (Solitron CER500)
E-603	48S10062A01	RECTIFIER, silicon (Solitron CER500)
E-604	48S10062A01	RECTIFIER, silicon (Solitron CER500)

Ref. No.	Part Number	Description
E-800	80C66390A13	CIRCUIT BREAKER: special
E-802	48C66037A06	RECTIFIER, silicon (Motorola SR76)
E-803	48C66037A06	RECTIFIER, silicon (Motorola SR76)
E-804	65S125595	PILOT LAMP: #1847
E-805	65S125595	PILOT LAMP: #1847
E-808	40C68091A02	SWITCH, thermal degaussing
E-900	65C66771A03	BULB, neon: NE2H
E-901	48C66865A03	CRYSTAL: special
E-905	80C68147A01	SPARK GAP (in C-00-1)
E-906	80C68147A01	SPARK GAP (in C-00-1)
E-907	80C68147A01	SPARK GAP (in C-00-1)
COILS & CHOKES		
L-100	---	PART OF E-100
L-101	---	PART OF E-100
L-102	---	PART OF E-100
L-103	24C66772A01	COMPENSATING: 7.5 uh
L-104	24C66772A01	COMPENSATING: 7.5 uh
L-105	24D67324A41	COMPENSATING: 220 uh
L-106	24C66772A09	COMPENSATING: 30 uh
L-107	24D67324A34	COMPENSATING: 125 uh
L-108	24D67324A50	COMPENSATING: 125 uh/2.7K
L-109	24D66855A09	DELAY LINE
L-110	24D67324A51	COMPENSATING: 300 uh/10K
L-111	24K750836	COMPENSATING: 50 uh
L-112	24D67324A49	COMPENSATING: 100 uh/8.2K
L-113	24D65828A21	COMPENSATING: 270 uh
L-200	24D67324A07	COMPENSATING: 450 uh
L-201	24D67324A40	COMPENSATING: 450 uh/10K
L-300	24C65828A25	COMPENSATING: 2.7 uh
L-301	24C66772A07	COMPENSATING: 1.5 uh
L-302	24P65133A26	AUDIO T.O. COIL ASSEM: incls C-301,C-302,C-303; R-302 & R-303
L-303	24V66545A29	AUDIO QUAD COIL ASSEM: incls C-312
L-500	24D65853A10	HORIZ OSCILLATOR
L-501	24C66772A02	COMPENSATING: 4.1 uh
L-502	24C66772A02	COMPENSATING: 4.1 uh
L-503	24C66772A03	COMPENSATING: 6.6 uh (USE 24C66772A05)
L-504	24C66772A03	COMPENSATING: 6.6 uh (USE 24C66772A05)
L-505	24D67730A08	COIL, CRT degaussing: upper or lower coil
L-506	24S135059	COMPENSATING: 6.2 uh
L-508	24D65853A13	HORIZ LINEARITY
L-509	24D65698A13	HORIZONTAL SIZE CONTROL
L-700	24D66857A05	TOP TILT PINCUSHION CORRECTOR
L-701	24D67822A05	YOKE, deflection: 92° compl; incls plug
L-702	24D67682A06	DYN CONV: incls core & mtg nut (R-G horiz lines)
L-703	1V68609A47	DYN CONV: incls core & mtg nut (R-G right side vert lines)
L-704	24D67682A03	DYN CONV: incls core & mtg nut (blue horiz tilt)
L-705	24D67682A03	DYN CONV: incls core & mtg nut (blue center horiz pulse)
L-706	24D66800A03	DYN CONV: incls cores; less radial magnet & spring (in C-00 to D-01 except D-00-1)
	24P65146A78	DYN CONV: incls cores; less radial magnet & spring (in D-00-1 only and E-00 & later)
L-707	24D66800A03	DYN CONV: incls cores; less radial magnet & spring (in C-00 to D-01 except D-00-1)
	24P65146A78	DYN CONV: incl cores; less radial magnet & spring (in D-00-1 only and E-00 & later)
L-708	24D66800A02	DYN CONV: incls cores; less radial magnet & spring (in C-00 to D-01 except D-00-1)
	24P65146A78	DYN CONV: incls cores; less radial magent & spring (in D-00-1 only and E-00 & later)
L-800	25C65806A10	CHOKE, filter
L-900	24C65828A43	COMPENSATING: 15 uh
L-901	24C65828A25	COMPENSATING: 2.7 uh
L-902	24C65828A43	COMPENSATING: 15 uh
L-903	24D67324A48	COMPENSATING: 150 uh/2.2K
L-904	24P65133A30	3.58MC OSC COIL ASSEM: incls C-913, C-916; R-915, R-918 & R-919
L-906	24D67324A40	COMPENSATING: 450 uh/10K
L-907	24D66857A06	3.58MC SCREEN TRAP
L-908	24C65828A42	COMPENSATING: 1000 uh/3.3K
L-909	24C66772A03	COMPENSATING: 6.6 uh
L-911	24S135220	COMPENSATING
L-915	24C66772A03	COMPENSATING: 6.6 uh
RESISTORS		NOTE: All resistors are insulated composition type unless otherwise specified.
	17S135203	820 10% 3W WW
	17S134152	820 10% 7W WW
	17S135176	1K 10% 20W WW
	17S646975	1500 10% 3W WW
	17S135288	1500 10% 7W WW
	6S125C57	2200 10% 1/2W glass (USE 6R129875)
	17S646519	2200 10% 3W WW (USE 17K641740)
	17S10130A13	2200 10% 5W WW
	17S642824	2200 10% 8W WW
	17S132446	2200 10% 10W WW
	17S647134	2700 10% 5W WW
	17K740922	3900 10% 4W glass (USE 17K740259)
	17B65648A04	4700 10% 2W glass (USE 17B132773)
	17S754325	5600 10% 7W WW
	17K739824	8200 10% 4W glass
	17K753336	10K 10% 2W glass (USE 6K125987)
	17K744464	10K 10% 3W glass
	17B65883A16	10K 10% 5W glass
	17K740258	10K 10% 10W WW
	17B750084	15K 10% 2W glass
	17K748432	15K 10% 4W WW
	17B65648A05	22K 10% 2W glass
	17K753338	27K 10% 2W glass (USE 6K131290)
	17K753335	47K 10% 2W glass (USE 6K122764)
	17B65648A08	56K 10% 2W glass
R-524	6D67800A03	FOCUS RESISTOR ASSEM (special)
R-722	6K743343	THERMISTOR: 3.8-20% @ 25° C; 0.424-2% @ 104.4° C
R-940	17S10130C78	7.5K 7W glass (2 required)
CONTROLS		
R-100	18D66401A13	IF TRAP NULL: 5K
R-115	18D66401A15	IF TRAP NULL: 200Ω (USE 18D66401A09)
R-128	18D67637A02	VIDEO PEAKING: 2K
R-132	18D67637A43	CONTRAST: 200Ω
R-133	18D67858A02	BRIGHTNESS: 2.7K
R-138	18D67637A26	DRIVE GREEN: 10K (USE 18D67637A31)
	18D67637A60	DRIVE GREEN: 15K (AG, G, H, & K23TS-A914)
R-139	18D67637A25	DRIVE BLUE: 10K (USE 18D67637A31)
	18D67637A59	DRIVE BLUE: 15K (AG, G, H, & K23TS-A914)
R-140	18D67637A58	DRIVE RED: 15K (AG, G, H, & K23TS-A914)
R-203	18D67637A16	G-2 RED: 3 meg (USE 18D67637A30)
R-205	18D67637A15	G-2 GRN: 3 meg (USE 18D67637A30)
R-206	18D67637A14	G-2 BLU: 3 meg (USE 18D67637A30)
R-220	18D67637A24	MASTER G-1: 500K
R-311	18D68021A01	VOLUME: 2 meg; incls on-off sw
R-312	18D67637A44	TONE: 1 meg
R-407	18D67637A29	AGC: 50K
R-415	18D67637A05	NOISE GATE: 2 meg
R-516	18D67637A04	HORIZ BIAS: 50K (USE 18D66836A15)
R-520	18D67311A06	HORIZ CENTER: 60Ω
R-526	18D67637A06	FOCUS: 10 meg
R-603	18D67637A42	VERTICAL HOLD: 750K
R-605	18D67637A35	VERTICAL SIZE: 3 meg
R-616	18D67637A34	VERTICAL LINEARITY: 250K
R-624	18D67311A02	VERTICAL CENTER: 100Ω WW
R-701	18D67671A01	RED-GRN VERT DIFF TILT: 30Ω WW
R-702	18D67671A07	RED-GRN VERT TILT: 200Ω WW
R-703	18D67671A07	BLUE VERT TILT: 200Ω WW
R-705	18D67671A12	RED-GRN LEFT SIDE VERT LINES: 60Ω WW (in C-00 to D-01 except D-00-1)
	18D67671A14	RED-GRN LEFT SIDE VERT LINES: 90Ω, 18Ω stop WW (in D-00-1 only and E-00 & later)
R-706	18D67671A11	RED-GRN HORIZ DIFF TILT: 150Ω WW
R-707	18D67671A05	RED-GRN VERT DIFF AMP: 500Ω WW (in C-00 to D-01 except D-00-1)
	18D67671A07	RED-GRN VERT DIFF AMP: 200Ω WW (in D-00-1 only and E-00 & later)
R-709	17D65820A16	BOTTOM AMP PINCUSHION: 10Ω
R-711	18D67671A07	RED-GRN VERT AMP: 200Ω WW
R-712	18D67671A02	BLUE VERT AMP: 60Ω WW (in C-00 to D-01 except D-00-1)
	18D67671A01	BLUE VERT AMP: 30Ω WW (in D-00-1 only and E-00 & later)
R-713	18D67671A04	BLUE HORIZ AMP: 150Ω WW (USE 18D67671A11)
R-725	18D67559A16	HORIZONTAL AMPLITUDE: 3K (horiz pincushion corrector)
R-902	18D67637A41	COLOR INTENSITY: 1500Ω
R-926	18D67637A40	TINT: 7 meg
R-928	18D67637A17	COLOR KILLER: 1 meg

Ref. No.	Part Number	Description
R-937	18D67637A39	HUE: 7500Ω (ANTS, NTS & PTS-A914)
TRANSISTORS		
Q-701	48S134838	TRANSISTOR, NPN (vertical pin cushion corrector)
Q-702	48S134910	TRANSISTOR, PNP (horizontal pincushion corrector)
TRANSFORMERS		
T-100	24D67362A03	1ST IF INTERSTAGE: incls mtg nut
T-101	24D67362A04	2ND IF INTERSTAGE: incls mtg nut
T-102	24V66546A12	VIDEO DET ASSEM: complete
T-103	24P65143A38	4.5MC TRAP ASSEM: complete
T-104	24P65133A28	COLOR T.O. COIL ASSEM: incls R-123
T-300	24P65133A25	4.5MC INTERSTAGE COIL ASSEM: incls C-306 & C-307
T-301	25D67552A05	AUDIO OUTPUT
T-500	24D67564A06	HORIZ OUTPUT & HV: compl; incls horiz pulse coil. Pri-Sec winding or horiz pulse coil may be purchased separately. Part numbers listed below.
	24D67565A05	PRIMARY-SECONDARY WINDING ONLY (Part of T-500)
	24D66875A10	COIL, horiz pulse (Part of T-500)
T-700	25D66761A07	VERTICAL OUTPUT
T-702	24D66847A08	PINCUSHION MODULATOR
T-710	24T66553A67	REACTOR, horizontal saturable
T-800	25D66841A16	POWER
T-801	24C67534A06	LINE FILTER
T-900	24P65143A34	COLOR IF ASSEM: complete
T-901	24V66549A89	COLOR SYNC INTERSTAGE ASSEM: incls C-929,C-930,C-931,C-935 & R-933
T-902	24V66549A91	COLOR SYNC FILTER ASSEM: incls C-925,C-926; R-930 & R-942
		MECHANICAL PARTS
	7D67151A04	BRACKET, convergence coil mtg (in D-00-1 only and E-00 & later)
	7D67151A03	BRACKET, convergence coil mtg (in C-00 to D-01 except D-00-1)
	84C67650A01	BOARD, plated chassis: convergence panel (less all components)
	43A754070	BUSHING, insul: plastic (UHF tuner mtg)
	43B67957A01	BUSHING, nylon (retains 12 pin plug)
	43C67077A03	BUSHING, snap-on: plastic (13/16 dia on HV shield)
	1V66550A48	CABLE, shielded hue: brn; 40"
	1V66550A47	CABLE, shielded intensity: red; 40"
	1V66545A81	CABLE ASSEMBLY: gating pulse; incls sleeving
	30D67870A02	CABLE & PLUGS ASSEMBLY (UHF to VHF tuner)
	1V66538A99	CABLE, coax: incls special ret (VHF tuner to chassis)
	42B66166A11	CLAMP, degausser cap mtg (D23TS-A914)
	42B65954A03	CLAMP, cable: for antenna leads
	42K481492	CLAMP, cable: plastic; 5/8" dia (chassis front)
	42C66880A01	CLAMP, spring: T-500 core mtg
	42B67218A01	CLAMP, yoke
	42A65602A01	CLIP, ground: UHF tuner to chassis
	42C67815A01	CLIP, lead: nylon (yoke lead dress)
	42K753665	CLIP, lead: plastic (focus leads)
	42C66799A01	CLIP, plastic: T-702 mtg
	42C66393A02	CLIP, retaining: WW resistor mtg (chassis front)
	42C66218A07	CLIP, spring nut (chassis mtg)
	9C66133A06	CONNECTOR, plate cap: T-500 (USE 9C66133A11)
	15S10183A04	CONNECTOR, plug: 3-pin; less contacts (on yoke)
	9K746369	CONNECTOR (pincushion corrector)
	15S10183A10	CONNECTOR, plug: 8-pin; less contacts (on chassis)
	15S10183A09	CONNECTOR, recept: 8-pin; less contacts (on yoke)
	15S10183A03	CONNECTOR, recept: 3-pin; less contacts (on pcc)
	9C67580A03	CONNECTOR, recept: 12-pin (convergence panel)
	42C65864A25	CONNECTOR, second anode: incls lead
	9A60992A01	CONNECTOR, wire: degausser leads
	39S10184A02	CONTACT, plug (3-pin & 8-pin plug)
	39S10184A01	CONTACT, recept (3-pin & 8-pin recept)
	76C66210A06	CORE, iron: T-500
A	44D67371A04	GEAR, driven (on tuner shaft)
B	44C67370A06	GEAR, driver (fine tune - incls shaft)
C	44C67370A02	GEAR, fine tune idler
	5K754071	GROMMET, insul (UHF tuner mtg)
	5S10115A04	GROMMET, rubber: .437 I.D. (HV shield; yoke leads)
	5A741077	GROMMET, strain relief: second anode lead
	14D67172A20	INSULATOR, control mtg (R & G drive)
	14D67172A21	INSULATOR, control mtg (focus, V center & H center)
	14B65732A07	INSULATOR, connector (use with 29D67429A04 lug)
	14B65732A04	INSULATOR, lug (use with 9C66402A04 lug)
	14B754181	INSULATOR, molded cup: V-13 socket
	29A739899	LUG, terminal: for speaker & antenna leads
	29D67429A04	LUG, terminal: (blu, blk & brn jumpers on convergence panel)
	9C66402A04	LUG, terminal: for .206 wide lug
	9C66402A05	LUG, terminal (pincushion assem leads)
	9C66402A03	LUG, terminal: spark gap ground wire
	59D68009A01	MAGNET, blue lateral & purity ring
	76D66816A06	MAGNET, radial: static conv
	2C720979	NUT, coil mtg: L-700
	2B66148A02	NUT, self-threading (T-500 core)
	2S10054A14	NUT, spring: clip-on (yoke mtg ring)
	2S132377	NUT, wing: 6-32 (conv coil)
	1V66542A58	PLATE CAP ASSEM: incls coil & lead - V-11)
	28K743342	PLUG, line cord: AC interlock (USE 28A736068)
	28C67679A02	PLUG, molded: 12-pin; convergence coil assem (in C-00 to D-01 except D-00-1)
	28C67679A03	PLUG, molded: 12-pin; convergence coil assem (in D-00-1 only and E-00 & later)
	28K749501	PLUG, 1-pin (UHF to VHF cable)
D	42C67369A01	RETAINER, gear
	47C66082A02	ROD, adjust (horiz hold)
	3S132346	SCREW, mach: 6-32 x 2-1/8 (conv coil)
	3S134277	SCREW, tpg: 6-18 x 1-1/4" lg (yoke mtg ring)
	43K754432	SLEEVE, UHF & VHF dial light
	9V66550A34	SOCKET, CRT: incls leads
	9D66770A09	SOCKET, 12-pin molded (V-13 - USE 9D66770A05)
	9K749378	SOCKET, transistor (for Q-701 & Q-702)
	9D66770A10	SOCKET, tube: 12-pin molded (V-11)
	9D66770A12	SOCKET, tube: 9-pin molded (V-12)
	9K470425	SOCKET, tube: 9-pin molded (V-15 - USE 9K702428)
	9C66296A07	SOCKET, tube: 9-pin wafer type; less center shield (USE 9C66296A08)
	9C66296A08	SOCKET, tube: 9-pin wafer type; with center shield
	9C66609A11	SOCKET, tube: 7-pin wafer type; with center shield
	9C65910A01	SOCKET, pilot lamp: incls brkt (UHF & VHF)
	1A67478A01	SPARK GAP ASSEMBLY: focus supply
	2C65722A06	SPEED NUT, clip-on: HV shield
	41C65987A01	SPRING, CRT aquadag ground
	41A67281A01	SPRING, retainer (CRT shield mtg)
	41C66795A02	SPRING, retaining (radial magnet static convergence)
	41A67320A01	SPRING, wire (blue lateral coil mtg)
	41A67955A01	SPRING, yoke support
	29A731948	TERMINAL: open ring (purity magnet ground wire)

68P65129 A31-B

MOTOROLA TV COLOR CHASSIS TS-918 SERIES

THIS SERVICE INFORMATION IS FOR THE USE OF QUALIFIED SERVICE PERSONNEL ONLY

INSTALLATION AND SERVICE ADJUSTMENTS

NOTE: DO NOT OPERATE CHASSIS WITH CONVERGENCE PLUG REMOVED FROM CONVERGENCE PANEL UNLESS THE +300V PP PULSE SOURCE HAS BEEN DISCONNECTED. SEE CONVERGENCE PANEL DETAIL ON SCHEMATIC DIAGRAM.

AUTOMATIC DEGAUSSER

This receiver is equipped with an automatic built-in degausser. It is a temperature controlled unit and is activated each time the receiver is turned on. The degaussing action takes place within the first 10 seconds after the receiver is turned on and before the picture comes on. The degaussing action cannot be seen. To degauss after the receiver has been on and has reached its maximum operating temperature, it will be necessary to turn the receiver off and allow it to cool for approximately 5 minutes. If the receiver has been on for only a few minutes, then the required cooling period is reduced.

Upon initial installation, we suggest you degauss the entire receiver and picture tube with a conventional portable degaussing coil.

FOCUSING ADJUSTMENT

Set brightness and contrast for normal picture. Then adjust focus control (located on chassis) for best overall focus, center to edge of screen.

DEFLECTION YOKE TILT ADJUSTMENT

Loosen the yoke retainer clamp and rotate yoke until picture is straight. Do not slide yoke forward or backwards on the neck of the tube as purity will be affected. Tighten the clamp screws when adjustment is completed.

PICTURE CENTERING

Vertical and horizontal centering controls are located on the rear of the chassis.

NOTE: Large control excursions will affect convergence.

COLOR KILLER

Tune in black and white picture. Starting with control in full clockwise position, when viewed from rear of receiver, turn control counter-clockwise slowly until color noise or snow disappears. Check all channels. If noise or snow remains on with a black and white picture, continue turning control counter-clockwise. Check setting when tuned to a color signal to make sure it was not over-adjusted on the black and white signal, thereby killing the color signal.

VERTICAL SIZE & LINEARITY

Both vertical size and linearity controls are located on the back of the chassis. Slight adjustments can be made with the vertical size control without affecting vertical linearity. Large control excursions should only be made prior to convergence.

HIGH VOLTAGE ADJUSTMENT

Reduce brightness control to minimum, full counter-clockwise (adjust master G-1, if necessary, to extinguish raster).

Measure the high voltage at the 2nd anode with an accurately calibrated 30KV voltmeter. Adjust horizontal bias control located at rear of chassis for 27KV 2nd anode voltage.

Alternate Method

Reduce brightness control to minimum, full counter-clockwise (adjust master G-1, if necessary, to extinguish raster).
With 120V AC line voltage, adjust horizontal bias control until 890V DC is measured at the raw boost terminal, see Figure A.

FINE TUNING ADJUSTMENT

This receiver employs a VHF tuner with a concentric pre-set fine tuning mechanism.

Rotating the fine tuning knob in either direction automatically engages the fine tuning mechanism and automatically disengages when knob is released.
To fine tune, rotate fine tuning knob in either direction for best picture and sound.

PINCUSHION ADJ. INSTRUCTIONS

VERTICAL: Adjust bottom amplitude control R-709 for minimum correction (maximum clockwise), then adjust top tilt coil L-700 for the straightest line possible near the top of screen.

Adjust R-709 for the straightest line possible near the bottom of the screen.

HORIZONTAL: Adjust horizontal control R-725 for optimum correction at left side of raster. Observe right side simultaneously, over correcting left side may cause barreling at right side of raster.

HORIZONTAL HOLD ADJUSTMENT (L-500)

Adjust the horizontal hold on the rear of the cabinet for most stable horizontal and color sync while switching from channel to channel.

AGC ADJUSTMENT

NOTE: AGC control is accurately adjusted at the factory. Avoid unnecessary adjustment.

To adjust, tune in a channel for best picture and sound. Turn the AGC control counter-clockwise (when viewed from rear of receiver) until the picture becomes unstable (rolls down or slips, etc). Then, turn control clockwise until the picture returns to normal. Check all channels; if any are unstable, continue turning control clockwise until the picture is normal on all channels.

VIDEO PEAKING CONTROL

The video peaking control should normally be set in maximum clockwise position for optimum video response. If high frequency background noise is visible on CRT, turn video peaking control counterclockwise to eliminate the background noise.

NOISE GATE CONTROL

The noise gate control is used to adjust the receiver for best hold stability under noise and different signal strength conditions.

To adjust, tune in a channel for best picture and sound. Turn the noise gate control clockwise (when viewed from rear of receiver) until the picture becomes unstable (rolls down or slips, etc.). Then turn control counter-clockwise until the picture just returns to normal. Check all channels; if any are unstable, continue turning control counter-clockwise until the picture is just normal on all channels.

TINT CONTROL

The tint control serves a dual purpose; on black and white, it is normally set to approximately the center of its range. On color programs, it is adjusted toward the right (clockwise) position for best flesh tones.

CONVERGENCE PROCEDURE

GENERAL CONVERGENCE PROCEDURE

The following eight steps outline, in general, the complete step by step convergence procedure that follows:

1. Demagnetize shadow mask with degaussing coil.
2. DC converge all three colors in center area of screen.
3. Adjust purity ring for center screen area red, adjust yoke position for outer area red.
4. Set tint control to its mechanical center and set black and white brightness tracking.
5. Properly center and size picture.
6. Dynamically converge all three colors.
7. Re-check Steps #2 and #3.
8. Repeat Step #4.

PURITY & CONVERGENCE PROCEDURE

PRELIMINARY PURITY ADJUSTMENTS

1. Connect crosshatch generator to antenna terminals and fine tune for best picture. Set brightness and contrast to normal.

2. Convergence panel is accessible from the front of receiver and is located behind removable panel (see Figure #2).

3. Check adjustment of vertical size and linearity, vertical centering, horizontal centering, center of screen focus and then adjust controls if necessary to obtain a pattern of proper focus, size and location (see Figure #3).

4. Demagnetize receiver (use degaussing coil around front and all sides of CRT).

5. Turn color intensity control to minimum. Adjust red and green disc magnets for super-imposed red and green pattern at the center of the screen (see Figure #1).

6. Adjust blue disc magnet and blue lateral magnet to place the blue pattern on top of the red and green patterns (see Figure #1).

These preliminary adjustments are necessary to have the three beams in their approximate positions before purity is adjusted.

PURITY

1. Tune receiver to a blank channel or crosshatch generator pattern having a white background. A white noise free raster can be obtained by setting tuner between channels.

2. Set contrast to minimum, brightness to normal level and tint control to its mechanical center (see Figure #2).

3. Turn blue and green G-2 controls to minimum and red G-2 to maximum (see Figure #2).

4. Move yoke as far back as possible without hitting the convergence yoke.

5. Starting with the colored or same shaped tabs on the purity ring together (see Figure #4), spread them slowly and rotate the purity ring as a unit to place the red area at the center of screen.

6. Slide yoke forward and position for best overall red field. Usually it is not necessary to slide yoke against the CRT bell.

7. Level deflection yoke and tighten yoke clamps.

8. Check the purity of the blue and green fields by turning down the red G-2 and turning up the blue and green G-2 controls in turn. Normally, when red field purity is obtained the green and blue fields are also pure. If either of the fields show impurity, adjust purity ring and/or yoke and then recheck the other two fields.

PRELIMINARY CONVERGENCE & BACKGROUND ADJUSTMENTS

When adjusting the set-up controls, the G-2 controls are adjusted to make the three beams extinguish at the same time (white raster at low brightness). The video drive controls are adjusted for a white raster at high brightness levels. The CRT should then remain white between these two extreme brightness settings.

NOTE: The tint control should change the white raster from red to white to blue.

1. Set drive controls to mid-position and set tint control to mid-position (see Figure #3).

2. Set master G-1 control to minimum.

3. Tune receiver to a blank channel and set contrast to minimum.

4. Adjust all G-2 controls to maximum (fully right).

5. Adjust BRIGHTNESS control until the raster is just visible (adjust master G-1 if necessary to see raster).

6. Observe color of raster and reduce the G-2 controls of the predominant colors. The G-2 control for the weakest color should be left at maximum, then bring other controls up to produce a gray raster.

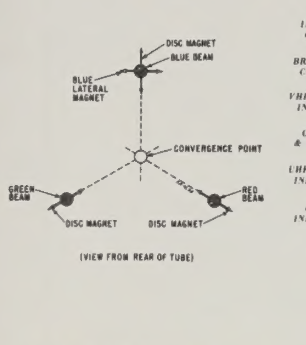


FIGURE 1. STATIC CONVERGENCE

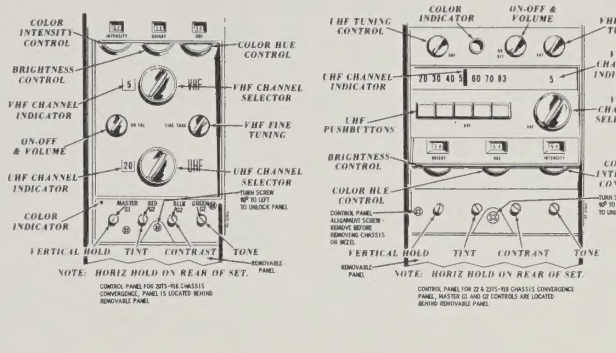


FIGURE 2. CONTROL PANELS

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7. Advance BRIGHTNESS control to maximum (clockwise) and contrast control to minimum (counter-clockwise). Set tuner between channels.

8. Set line voltage at 120V AC. Measure voltage at boost terminal, Figure A. Starting with master G-1 at minimum (counter-clockwise), adjust master G-1 for a 40 volt DC drop in boost.

Alternate Method

Set BRIGHTNESS control to maximum (clockwise) position and contrast control to minimum (counter-clockwise) position. Starting with the master G-1 control in its maximum counter-clockwise position, slowly rotate the master G-1 control until the picture just STARTS to go out of focus. Then turn the control back approximately 45°.

9. Reduce BRIGHTNESS control to normal brightness and check color of screen. If screen is white or gray (with tint control in its mid-position), set-up procedure is completed. If any color is dominant, proceed with Step #10.

10. Touch-up video drive controls, if necessary, to produce a warm white raster.
11. Reduce BRIGHTNESS to gray raster and touch-up G-2 controls, if necessary.

A. STATIC CONVERGENCE

1. Tune receiver to a white crosshatch and adjust for best picture.

2. Re-check center of screen focus, picture size, linearity and centering; correct if necessary.

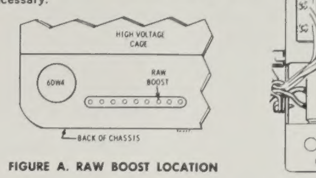
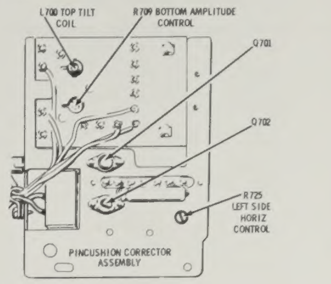


FIGURE A. RAW BOOST LOCATION

3. Adjust the three disc magnets and the blue lateral magnet for convergence of all three beams at the center of the screen (see Figure #4).



L700 TOP TILT COIL
R709 BOTTOM AMPLITUDE CONTROL
Q701
Q702
R725 LEFT SIDE HORIZ CONTROL
PINCUSHION CORRECTOR ASSEMBLY

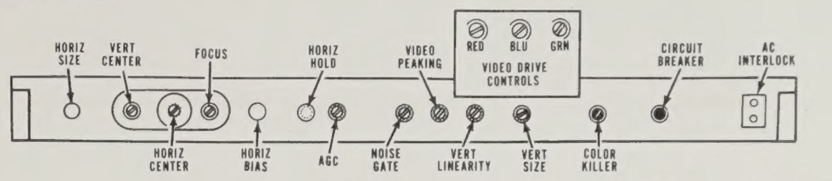
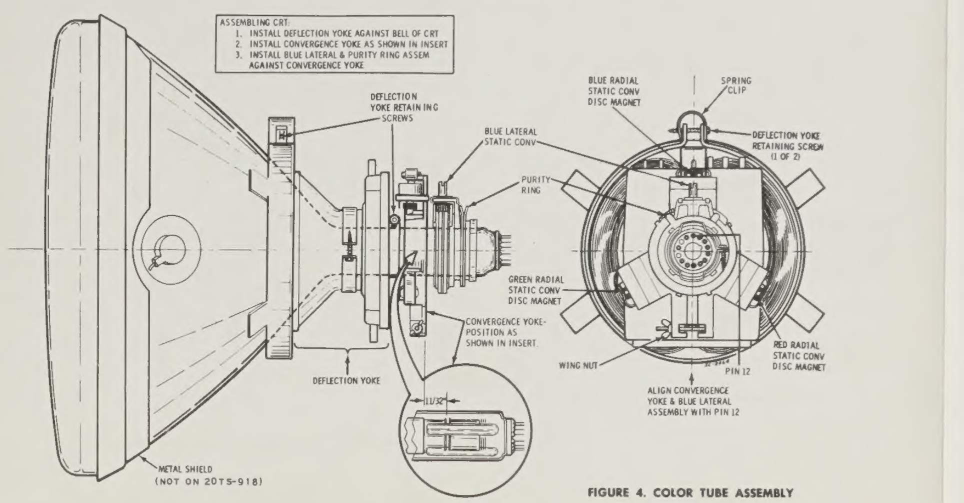


FIGURE 3. REAR VIEW OF CHASSIS



ASSEMBLING CRT:
1. INSTALL DEFLECTION YOKE AGAINST BELL OF CRT
2. INSTALL CONVERGENCE YOKE AS SHOWN IN INSERT
3. INSTALL BLUE LATERAL & PURITY RING ASSEM AGAINST CONVERGENCE YOKE
DEFLECTION YOKE RETAINING SCREWS
BLUE LATERAL STATIC CONV
PURITY RING
BLUE RADIAL STATIC CONV DISC MAGNET
SPRING CLIP
DEFLECTION YOKE RETAINING SCREW (1 OF 2)
GREEN RADIAL STATIC CONV DISC MAGNET
CONVERGENCE YOKE POSITION AS SHOWN IN INSERT
RED RADIAL STATIC CONV DISC MAGNET
WING NUT
PIN 12
DEFLECTION YOKE
ALIGN CONVERGENCE YOKE & BLUE LATERAL ASSEMBLY WITH PIN 12
METAL SHIELD (NOT ON 20TS-918)

FIGURE 4. COLOR TUBE ASSEMBLY

B. DYNAMIC CONVERGENCE

Vertical Dynamics

NOTE: If a chassis is being converged for the first time, after a CRT has been replaced or if a component that directly effects dynamic convergence is replaced, switches E701 and E702 (located adjacent to convergence panel) should be set in normal position. The normal position of switches on chassis 22 or 23TS-918 is down. For chassis 20TS-918 normal position is left. See Figure 5 for switch location.

Obtain a red-green raster by turning blue G-2 to minimum. Use Figure #5, the convergence panel diagram, and observe the effect as illustrated at each control.

1. Adjust R-G vertical amp to converge the center vertical line at bottom of screen (Step #1).

2. Adjust R-G vertical tilt to converge the center vertical line at top of screen (Step #2).

NOTE: If the range of the R-G Vertical amp and tilt controls is inadequate set slide switch E701 in "up" position on chassis 22 & 23TS-918 and to the right on chassis 20TS-918. See figure 5 for location.

Alternately repeat Steps #1 and #2 for best convergence at top and bottom of center vertical line. Best convergence is obtained by super-imposing the lines from the center outward. However, the proper adjustment of these controls may result in the red and green lines being parallel. If this condition exists, converge the lines by using the disc magnets.

3. Adjust the R-G vertical differential amp control to converge a horizontal line near the bottom of the screen (Step #3).

4. Adjust the R-G vertical differential tilt to converge a horizontal line near the top of the screen (Step #4).

If the horizontal lines in the center of the screen are misconverged, repeat Steps #3 and #4 for equally spaced horizontal lines from top to bottom of screen. Re-adjust disc magnets if necessary. Re-adjust the R-G vertical amp and tilt controls (Steps #1 and #2) for center vertical lines, if necessary.

5. Turn up the blue G-2 control and reduce the blue vertical amp to minimum (Step #5).

6. Adjust the blue vertical tilt control to produce equal displacement in the same direction of the blue horizontal lines with respect to red and green at the top and the bottom of screen (Step #6).

Adjust the blue vertical amp to produce displacement in the same direction of the blue horizontal lines from the top thru the center and to the bottom of the screen (Step #5).

NOTE: If the range of the blue vertical amp and tilt controls is inadequate set slide switch E702 in "up" position on chassis 22 & 23TS-918 and to the right on chassis 20TS-918. See Figure 5 for location.

Alternately repeat Step #5 and Step #6 for satisfactory convergence of the blue horizontal lines from top to bottom of screen along the center of screen, or for equal displacement to permit convergence with the disc magnets.

Horizontal Dynamics

Turn off the blue G-2 leaving the red and green fields on the screen.

7. Adjust the right-side R-G vertical line control to make the vertical lines from the center to the right side converge (Step #7).

8. Adjust the left-side R-G vertical line control to make the vertical lines from the center to the left side converge (Step #8).

Re-touch the right and left R-G vertical line controls for best overall convergence of the vertical lines or for an error that lends itself to correction by the disc magnets.

9. Pre-adjust R-G differential tilt control (#10) to center of range. Adjust horizontal line control (#9) to make R-G center lines converge. Any remaining displacement at either side of the screen should be equal and exist in the same direction.

10. Adjust horizontal differential tilt control to make the center horizontal R&G lines converge in the center of the screen or be equal in displacement to permit convergence with the disc magnets. It may be necessary to readjust between steps #9 and #10 to completely converge center line across the screen.

Repeat Steps #7, #8, #9 and #10 for best overall convergence, or for equal spacing of lines which can be corrected with the disc magnets.

11. Turn up the blue G-2 control. The blue horizontal amp control which is also used in Step #14 must first be adjusted to maximum clockwise rotation (Step #11).

12. Adjust the blue horizontal tilt control until the droop in the blue line is in the center of the screen (Step #12).

13. Adjust the blue horizontal phase until the droop in the blue line is forced upward (Step #13).

14. Re-adjust blue horizontal amp control until blue line is converged on R-G line along a center horizontal line or for equal displacement to permit convergence with the disc magnets (Step #14).

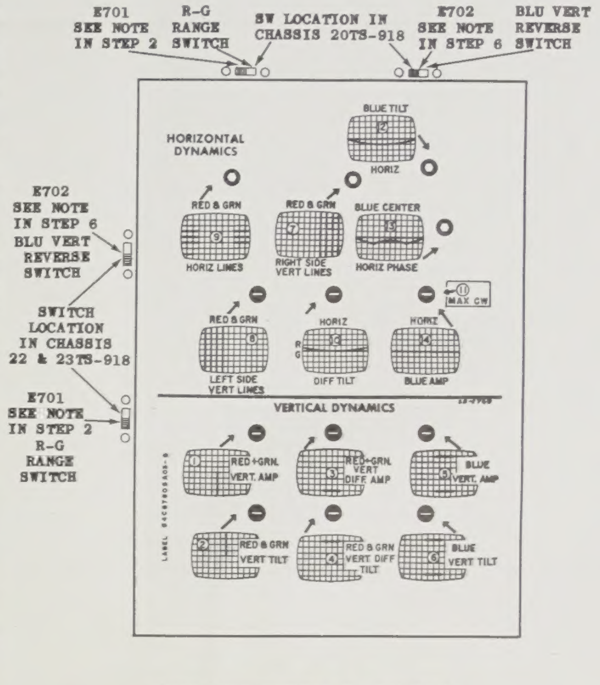


FIGURE 5. CONVERGENCE PANEL - FRONT VIEW

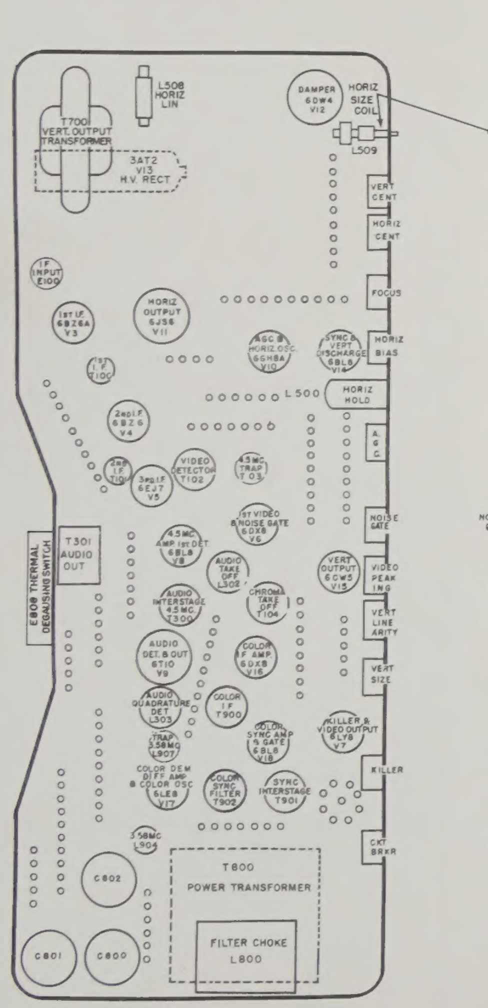
NOTE: If the displacement of the blue line is not equal on both ends with respect to R-G line, readjust blue horizontal tilt control (Step #12).

Repeat Steps #12, #13 and #14, if necessary, to get a satisfactory convergence along a center horizontal line or to get equal displacement to permit correction with the disc magnets.

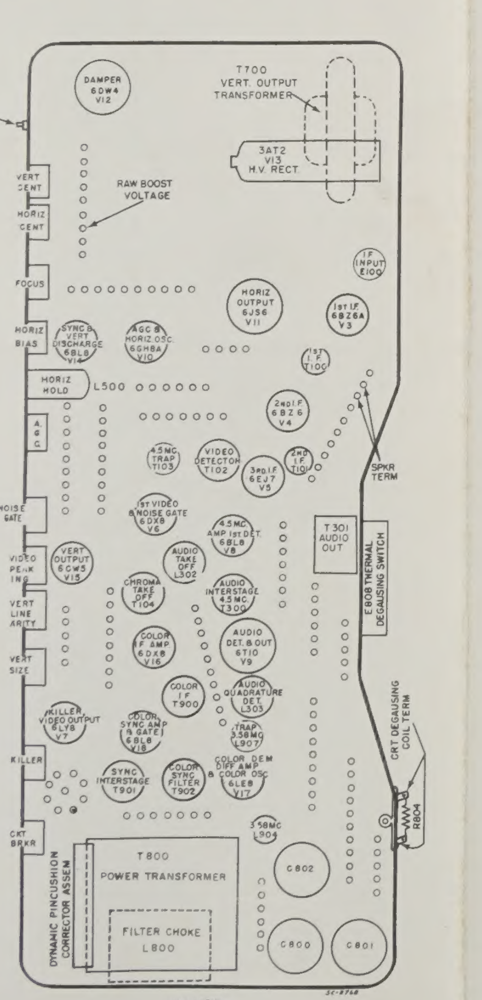
15. Re-check disc magnets. The pattern should now be converged.

The G-2 controls should now be reset for a white background. Generally, since the blue G-2 is the only one disturbed, it is possible to set this control at its proper adjustment at low brightness while observing a local station.

If the purity ring is re-adjusted for any reason, the entire convergence procedure must be repeated.



BOTTOM VIEW



TOP VIEW

REPLACEMENT PARTS LIST

Ref. No.	Part Number	Description
ELECTRICAL PARTS		
CAPACITORS - NOTE: The capacitors in this list are recommended replacement types for the original equipment; all are ceramic disc type unless otherwise specified.		
C-133, 907 & 920	21S115956	1.0 pf 10% 500V fixed comp
C-404	21S132473	2.2 pf +.25 1KV NPO
C-915 & 917	21S132305	8.2 pf 5% 500V NPO
C-914	21S410063	10 pf 5% 500V NPO
C-124	21S121462	12 pf 10% 500V N150
C-919	21S120578	18 pf 10% 500V N150
C-121	21S131310	18 pf 10% 500V NPO
C-319	21S120539	22 pf 10% 500V N150
C-503	21S180B23	27 pf 10% 500V N750 (USE 21S122050)
C-525	21S180B31	33 pf 10% 2KV N150
C-530	21S180B76	47 pf 10% N1500 6KV
C-509	21S124472	56 pf 10% 500V N150
C-25	21S180A95	68 pf 5% 500V NPO
C-200	21S129652	68 pf 10% 500V N750
C-924	21S131554	82 pf 10% 500V N1500
C-523	21P65133A34	100 pf 5% 3KV N1500 spcl corona free (USE 21K120543)
C-125 & 208	21S180A98	100 pf 10% 500V Z5F (USE 21S132462)
C-410, 500 & 502	21S125723	100 pf 20% 500V Z5F (USE 21R410036)
C-933	21S180B21	120 pf 10% 1KV N750
C-923	21S180B38	120 pf 10% Z5F
C-510	21S121698	220 pf 10% 500V Z5F (USE 21R132503)
C-921	21S132258	270 pf 20% 500V Z5F
C-106 & 111	21S127090	330 pf 10% 500V Z5F
C-309	21S132260	390 pf 20% 500V Z5F
C-316	21S180B33	470 pf 20% 1KV Z5F
C-506	21S121797	470 pf 10% 500V Z5F
C-402	21S121478	470 pf 20% 2KV Z5U
C-902 & 928	21S131336	560 pf 10% 500V Z5F
C-932 & 927	21S129510	680 pf 10% 500V Z5F (USE 21K752395)
C-105	21S124802	800 pf 10% 500V Z5F
C-123 & 128	21S128045	.001 mf 10% 500V Z5F
C-206, 317 & 527	21S124456	.001 mf 20% 2KV Z5U (USE 21R128242)
C-5,600, 602 & 918	21S410127	.001 mf 20% 500V Z5F (USE 21A121678)
C-809, 810 & 812	21S132293	.001 mf +100-0% 500V Z5U
C-201, 203 & 204	21S124541	.001 mf +100-0% 2KV Z5U
C-409	21S131816	.0015 mf 20% 500V Z5F
C-813	21S132419	.0015 mf +100-0% 1.4KV Z5U
C-114, 116,129, 315 & 501	21S121836	.002 mf 10% 500V Z5F
C-104, 107,108, 110,112, 113,115, 117,118, 300,304, 814,816, 807 & 815	21S180A53	.002 mf +100-0% 500V Z5U
C-607, 612 & 707	21S125899	.002 mf 10% 2KV Z5F
C-711	8S10072A06	.002 mf 10% 400V
C-305	21S180A15	.0022 mf 20% 500V Z5F
C-722	21S180B29	.0022 mf 10% 500V mylar (USE 21R129878)
	21S121882	.0022 mf 20% 500V Z5F
C-504	21S127855	.0033 mf 10% 500V Z5F (USE 21K746523)
C-310, 318,601, & 808	21S122871	.005 mf 20% 500V Z5U (USE 21R128634)
C-511 & 529	21S124738	.005 mf +100-0% 1KV Z5U
C-202	21S120093	.005 mf +100-0% 2KV Z5U
C-311 & 405	21S180A45	.005 mf 20% 500V Z5F (USE 21R128634)
C-126	21S131333	.0068 mf 10% 500V Z5F
C-507	8S10072A05	.0068 mf 10% 400V mylar (class "E")

Ref. No.	Part Number	Description
C-706	8S10072A23	.01 mf 10% 200V mylar (class "E" - USE 8S10072A20)
C-603	8S10072A20	.01 mf 10% 400V mylar (class "E")
C-408, 514,804, 806,901 & 913	21S121946	.01 mf 20% 500V Z5U (USE 21K751089)
C-313	21S122789	.01 mf 20% 1KV Z5U (USE 21R124832)
C-905, 900 & 906	21S131994	.01 mf +80-20% 500V Z5U
C-609	8S10064A78	.01 mf 20% 1KV mylar
C-708	21S180B34	.02 mf 10% 1KV Z5F
C-508	8S10072A06	.022 mf 10% 400V mylar (class "E")
C-705	8S10072A24	.025 mf 10% 200V mylar (class "E")
C-606	8S10064A85	.033 mf 10% 600V mylar
C-134	8S10064E12	.033 mf 20% 600V mylar (USE 8R10110A04)
C-610	8S10064B24	.039 mf 10% 600V mylar
C-605	8S10064E13	.039 mf 20% 600V mylar (USE 8R10110A05)
C-719	8S10064B27	.047 mf 10% 200V mylar
C-130, 411 & 608	8S10064C15	.05 mf 20% 200V mylar (class "E" - USE 8R10064D15)
C-531	8S10064D15	.05 mf 20% 400V mylar
C-314, 522 & 528	8S10064E15	.05 mf 20% 600V mylar (USE 8R10064A46)
C-903, 904 & 922	21S180A57	.05 mf +80-20% 100V Z5U (USE 21S132524)
C-701	8S10072A21	.056 mf 10% 200V mylar (class "E" - USE 8S10072A01)
C-702, 704 & 614	8S10072A22	.1 mf 10% 200V mylar (class "E" - USE 8S10072A03)
C-205 & 207	8S10064A02	.1 mf 20% 400V mylar (USE 8R10064D17)
C-934	8S10064D17	.1 mf 20% 400V mylar
C-521 & 524	8S10064A82	.1 mf 10% 600V mylar
C-515	8S10064E17	.1 mf 20% 600V mylar (USE 8R10064A45)
C-403, 908 & 910	8S10064C18	.15 mf 20% 200V mylar (USE 8R10064D18)
C-1, 3 & 810	21S134271	.15 mf 20% 400V impreg paper
C-720	8S10064B28	.22 mf 20% 200V mylar (USE 8S10064A12)
C-517	8S10064A24	.25 mf 20% 50V mylar
C-131, 400,401 & 512	8S10064A83	.25 mf 20% 400V mylar (radial leads - USE 8S10064A67)
C-505	8S10064A84	.39 mf 20% 200V mylar
C-614	8C67728A01	.47 mf 20% 600V special
C-127	8S10064A03	.5 mf 20% 100V mylar (USE 8R10064B23)
C-721	8S10064A69	.5 mf 20% 200V mylar
C-520	8C67779B03	1.0 mf 20% 600V tub spcl
C-709	23D65282A34	5 mf 3V lytic
C-308	23D65282A03	10 mf/15V
	23C65808A22	10 mf/25V lytic
C-714	23D65828A35	20 mf 25V lytic
C-703	23D65282A23	30 mf/20V lytic
C-611	23C65808A08	50 mf/150V lytic
C-800	23C67753A03	50 mf/450V; 10 mf/400V; 160 mf/250V lytic
C-801	23C67753A01	80 mf/450; 80 mf/450; 20 mf/400V lytic
C-718	23D65282A39	100 mf +100-0% 25V lytic
C-518 & 519	23C65808A22	100 mf/80V +100-0%
C-132	23C65808A13	150 mf/25V lytic (USE 23C60119A15)
C-802	23C67753A02	160 mf/250V lytic (USE 23C65807A07)
MISCELLANEOUS ELECTRICAL PARTS		
E-100	24V66550A32	IF INPUT ASSEMBLY: complete
E-101	48C65837A02	DIODE, crystal (Erie ED1891)
E-200	48P65145A74	DIODE, low power (Motorola SR76)
E-400	51D65239A21	RES-CAP, clipper
E-500	48D67120A02	DIODE, low power (Transitron SG3272)
E-501	48D67120A02	DIODE, low power (Transitron SG3272)
E-502	48P65145A74	DIODE, low power (Solitron CER500)

Ref. No.	Part Number	Description
E-503	48P65145A74	DIODE, low power (Transitron SG3400)
E-504	48C67926A01	RECTIFIER, silicon (Solitron CER500)
E-505	48C67926A01	RECTIFIER, silicon (Solitron CER500)
E-506	48C67926A01	RECTIFIER, silicon (Solitron CER500)
E-600	48C65837A02	DIODE, crystal (Erie ED1891)
E-601	51D65239A22	RES-CAP, integrator
E-602	48S10062A01	RECTIFIER, silicon (Solitron CER500)
E-603	48S10062A01	RECTIFIER, silicon (Solitron CER500)
E-604	48S10062A01	RECTIFIER, silicon (Solitron CER500)
E-701	40C65513A01	SWITCH, slide: R-G vert dyn tilt reversing
E-702	40C65513A05	SWITCH, slide: blue vert reversing
E-800	80C66390A13	CIRCUIT BREAKER: special
E-802	48S191A06	RECTIFIER, silicon (Motorola 91A06)
E-803	48S191A06	RECTIFIER, silicon (Motorola 91A06)
E-805	•65S135685	PILOT LAMP: 6.3V
E-806	•65S135685	PILOT LAMP: 6.3V
E-807	•65S135685	PILOT LAMP: 6.3V
E-808	40P65143A39	SWITCH, thermal degaussing
E-900	65C66771A03	BULB, neon: NE2H
E-901	48C66865A03	CRYSTAL: 3.579545MC
E-905	80C68147A01	SPARK GAP
E-906	80C68147A01	SPARK GAP
E-907	80C68147A01	SPARK GAP
E-908	1A67478A02	SPARK GAP (Focus Volt)
COILS & CHOKES		
L-100	---	PART OF E-100
L-101	---	PART OF E-100
L-102	---	PART OF E-100
L-103	24C66772A01	COMPENSATING: 7.5 uh
L-104	24C66772A01	COMPENSATING: 7.5 uh
L-105	24D67324A41	COMPENSATING: 220 uh
L-106	24C66772A09	COMPENSATING: 30 uh
L-107	24D67324A34	COMPENSATING: 125 uh
L-108	24D67324A34	COMPENSATING: 125 uh
L-109	24D66855A09	DELAY LINE
L-110	24D68002A27	COMPENSATING: 300 uh
L-111	24K750836	COMPENSATING: 50 uh
L-112	24D68002A28	COMPENSATING: 100 uh
L-113	24D65828A21	COMPENSATING: 270 uh
L-200	24D67324A07	COMPENSATING: 450 uh
L-201	24D67324A07	COMPENSATING: 450 uh
L-300	24D68002A29	COMPENSATING: 2.7 uh
L-301	24C66772A07	COMPENSATING: 1.5 uh
L-302	24P65133A26	AUDIO T.O. COIL ASSEM: incls C-301,C-302,C-303; R-302 & R-303
L-303	24V66545A29	AUDIO QUAD COIL ASSEM: incls C-312
L-500	24D65853A10	HORIZ OSCILLATOR
L-501	24C66772A02	COMPENSATING: horiz suppressor 4.1 uh
L-502	24C66772A02	COMPENSATING: 4.1 uh
L-503	24C66772A03	COMPENSATING: 6.6 uh (USE 24C66772A05)
L-504	24C66772A03	COMPENSATING: 6.6 uh (USE 24C66772A05)
L-505	24D67730A08	COIL, CRT degaussing: upper or lower coil
L-506	24S135059	COMPENSATING: 6.2 uh
L-508	24D65853A13	HORIZ LINEARITY
L-509	24D65698A13	HORIZONTAL SIZE CONTROL
L-700	24D66857A05	TOP TILT PINCUSHION CORRECTOR
L-701	24D67822A07	YOKE, deflection: 92° compl; incls plug
L-702	24D67682A06	DYN CONV: incls core & mtg nut (R-G horiz lines)
L-703	24D67682A07	DYN CONV: incls core & mtg nut (R-G right side vert lines)
L-704	24D67682A03	DYN CONV: incls core & mtg nut (blue horiz tilt)
L-705	24D67682A03	DYN CONV: incls core & mtg nut (blue center horiz pulse)
L-706	24P65145A44	DYN CONV: incls cores; less radial magnet & spring (red)
L-707	24P65145A44	DYN CONV: incls cores; less radial magnet & spring (green)
L-708	24P65145A43	DYN CONV: incls cores; less radial magnet & spring (blue)
L-800	25C65806A10	CHOKE, filter
L-900	24C65828A43	COMPENSATING: 15 uh
L-901	24C65828A25	COMPENSATING: 2.7 uh
L-902	24C65828A43	COMPENSATING: 15 uh
L-904	24P65133A30	3.58MC OSC COIL ASSEM: incls C-913,C-916; R-915,R-918 & R-919
L-906	24D67324A40	COMPENSATING: 450 uh/10K
L-907	24D66857A06	3.58MC SCREEN TRAP
L-908	24D68002A26	COMPENSATING: 1000 uh
L-909	24C66772A03	COMPENSATING: 6.6 uh
L-911	24S135220	CHOKE, radiation
L-915	24C66772A03	COMPENSATING: 6.6 uh
RESISTORS - NOTE: All resistors are insulated composition type unless otherwise specified.		

Ref. No.	Part Number	Description
R-618	17S135203	820 10% 3W WW
R-623	17S134152	820 10% 7W WW
R-801	17S135176	1K 10% 20W WW
R-729	17S10130A23	RES FXD MTL FLIM 1500 10% 2W (USE 6R121896)
	17S646375	1500 10% 3W WW
R-130	17S10130A13	2200 10% 5W WW
R-800	17S132446	2200 10% 10W WW - or 17S642824
R-620	17S647134	2700 10% 7W WW (not in all sets)
R-118	17K740922	3900 10% 4W glass (USE 17K740259)
R-931	17B65648A04	4700 10% 2W glass (USE 17B132773)
R-135	17S754325	5600 10% 7W WW
R-10 & R-11	17K739824	8200 10% 4W glass
R-16 & 17	17K739824	8.2K 7W glass
R-907	17K753336	10K 10% 2W glass (USE 6K125987)
R-136 & 137	17K744464	10K 10% 3W glass
R-910	17B65883A16	10K 10% 5W glass
R-519	17K740258	10K 10% 10W WW
R-134	17B750084	15K 10% 2W glass
	17K748432	15K 10% 4W WW
R-939	17B65648A05	22K 10% 2W glass
R-906	17K753338	27K 10% 2W glass (USE 6K131290)
R-932	17K753335	47K 10% 2W (USE 6K122764)
R-6	17S743157	47K 10% 4W glass
R-502	17B65648A08	56K 10% 2W glass
R-524	6D67800A03	FOCUS RESISTOR ASSEM (special)
R-722	6K743343	THERMISTOR: 3.8-20% @ 25° C; 0.424-2% @ 104.4°C
R-940	17S10130C78	7.5K 7W glass (2 required)
CONTROLS		
R-100	18D66401A13	IF TRAP NULL: 5K
R-115	18D66401A15	IF TRAP NULL: 200Ω (USE 18D66401A09)
R-128	18D67637A02	VIDEO PEAKING: 2K
R-132 A & B	•18D68221A03	CONTRAST & BLU G2: contrast 200Ω; Blu G2 3 meg (20TS-918)
R-132	•18D67637A52	CONTRAST: 200Ω (22TS & 23TS-918)
R-133	•18D68222A04	BRIGHTNESS: 2.7K (20TS, 22TS & 23TS-918)
R-138	•18D67637A60	DRIVE GREEN: 15K
R-139	•18D67637A59	DRIVE BLUE: 15K
R-140	•18D67637A58	DRIVE RED: 15K
R-203	18D67637A16	G-2 RED: 3 meg (22TS & 23TS-918)
R-205	18D67637A15	G-2 GRN: 3 meg (22TS & 23TS-918)
R-206	18D67637A14	G-2 BLU: 3 meg (22TS & 23TS-918)
R-220	18D67637A24	MASTER G-1: 500K (22TS & 23TS-918)
R-311	•18D68021A05	VOLUME: 2 meg; incls on-off sw (22TS & 23TS-918)
R-311	•18D68021A02	VOL & ON-OFF SW: vol 2 meg (20TS-918)
R-312	•18D67637A53	TONE: 1 meg: (22TS & 23TS-918)
R-312 A & B	•18D68221A04	TONE & G-2: tone 1 meg; grn G-2 3 meg (20TS-918)
R-407	18D67637A29	AGC: 50K
R-415	18D67637A05	NOISE GATE: 2 meg
R-516	18D67637A04	HORIZ BIAS: 50K (USE 18D66836A15)
R-520	18D67311A06	HORIZ CENTER: 60Ω
R-526	18D67637A06	FOCUS: 10 meg
R-603	•18D67637A51	VERTICAL HOLD: 750K (22TS & 23TS-918)
R-603 A & B	•18D68221A01	VERT HOLD & MASTER G-1: vert hold 750K; master G-1 500K (20TS-918)
R-605	18D67637A35	VERTICAL SIZE: 3 meg
R-616	18D67637A34	VERTICAL LINEARITY: 250K
R-624	18D67311A02	VERTICAL CENTER: 10Ω WW
R-701	18D67671A01	RED-GRN VERT DIFF TILT: 30Ω WW
R-702	18D67671A07	RED-GRN VERT TILT: 200Ω WW
R-703	18D67671A07	BLUE VERT TILT: 200Ω WW
R-705	18D67671A12	RED-GRN LEFT SIDE VERT LINES: 60Ω WW
R-706	18D67671A11	RED-GRN HORIZ DIFF TILT: 150Ω WW
R-707	18D67671A05	RED-GRN VERT DIFF AMP: 500Ω WW
R-709	17D65820A16	BOTTOM AMP PINCUSHION: 10Ω
R-711	18D67671A07	RED-GRN VERT AMP: 200Ω WW
R-712	18D67671A02	BLUE VERT AMP: 60Ω WW
R-713	18D67671A04	BLUE HORIZ AMP: 150Ω WW (USE 18D67671A11)
R-725	18D67559A16	HORIZONTAL AMPLITUDE: 3K (horiz pincushion corrector
R-902	•18D68222A03	COLOR INTENSITY: 1500Ω
R-926	•18D67637A57	TINT: 7 meg (22TS & 23TS-918)
R-926 A & B	•18D68221A05	TINT & RED G-2: tint 7 meg; red G-2 3 meg (20TS-918)
R-928	18D67637A17	COLOR KILLER: 1 meg
R-937	18D68222A01	HUE: 7500Ω (20TS, 22TS & 23TS-918)
R-937	•18D68031A03	HUE CONTROL: 7.5K (A22TS-918 only)
TRANSISTORS		
Q-701	48S134838	TRANSISTOR, NPN (vertical pin cushion corrector)

Ref. No.	Part Number	Description
Q-702	48S134910	TRANSISTOR, PNP (horizontal pincushion corrector)
TRANSFORMERS		
T-100	24D67362A03	1ST IF INTERSTAGE: incls mtg nut
T-101	24D67362A04	2ND IF INTERSTAGE: incls mtg nut
T-102	24V66546A12	VIDEO DET ASSEM: complete
T-103	24P65143A38	4.5MC TRAP ASSEM: complete
T-104	24P65133A28	COLOR T.O. COIL ASSEM: incls R-123
T-300	24P65133A25	4.5MC INTERSTAGE COIL ASSEM: incls C-306 & C-307
T-301	25D67552A05	AUDIO OUTPUT
T-500	24D67564B06	HORIZ OUTPUT & HV: compl; incls horiz pulse coil. Pri-Sec winding or horiz pulse coil may be purchased separately. Part number listed below.
	24D67565A05	PRIMARY-SECONDARY WINDING ONLY (Part of T-500)
	24D66875A10	COIL, horiz pulse (Part of T-500)
T-700	25D66761A07	VERTICAL OUTPUT
T-702	24D66847A08	PINCUSHION MODULATOR: vertical
T-710	24T66553A67	REACTOR, horizontal saturable
T-800	25D66841A16	POWER
T-801	24C67534A06	LINE FILTER
T-900	24P65143A34	COLOR IF ASSEM: complete
T-901	24V66549A89	COLOR SYNC INTERSTAGE ASSEM: incls C-929,C-930,C-931,C-935 & R-933
T-902	24V66549A91	COLOR SYNC FILTER ASSEM: incls C-925,C-926; R-930 & R-942
MECHANICAL PARTS		
	84C67650A03	BOARD, plated chassis: convergence panel (less all components
	43A754070	BUSHING, insul: plastic (UHF tuner mtg)
	43B67957A01	BUSHING, nylon (retains 12 pin plug)
	43C67077A03	BUSHING, snap-on: plastic (13/16 dia on HV shield)
	•1V66556A95	CABLE, shield hue: brn
	•1V66556A94	CABLE, shielded intensity: red
	1V66556A90	CABLE, shielded audio (blk)
	1V66545A81	CABLE ASSEMBLY: gating pulse; incls sleeving
	•1V66556A91	CABLE, shielded audio (wht)
	30D67870A02	CABLE & PLUGS ASSEMBLY (UHF to VHF tuner)
	1V66538A99	CABLE, coax: incls special ret (VHF tuner to chassis)
	42B66166A11	CLAMP, degausser cap mtg (D23TS-A914)
	42B65954A03	CLAMP, cable: for antenna leads
	42K481492	CLAMP, cable: plastic; 5/8" dia (chassis front)
	42C66880A01	CLAMP, spring: T-500 core mtg
	42A65602A01	CLIP, ground: UHF tuner to chassis
	42C67815A01	CLIP, lead: nylon (yoke lead dress)
	42K753665	CLIP, lead: plastic (focus leads)
	42C66799A01	CLIP, plastic: T-702 mtg
	•42C67981A01	CLIP, cap mtg: on UHF tuner brkt
	42C66393A02	CLIP, retaining: WW resistor mtg (chassis front)
	42C66218A07	CLIP, spring nut (chassis mtg)
	9C66133A06	CONNECTOR, plate cap: T-500 (USE 9C66133A11)
	15S10183A04	CONNECTOR, plug: 3-pin; less contacts (on yoke)
	9K746369	CONNECTOR (pincushion corrector)
	15S10183A10	CONNECTOR, plug: 8-pin; less contacts (on chassis)
	15S10183A09	CONNECTOR, recept: 8-pin; less contacts (on yoke)
	15S10183A03	CONNECTOR, recept: 3-pin; less contacts (on pcc)
	9C67580A03	CONNECTOR, recept: 12-pin (convergence panel)
	42C65864A25	CONNECTOR, second anode: incls lead (20TS-918 only)
	•42C65864A29	CONNECTOR, second anode: incls lead (USE 42C65864A26)
	9A60992A01	CONNECTOR, wire: degausser leads
	39S10184A02	CONTACT, plug (3-pin & 8-pin plug)
	39S10184A01	CONTACT, recept (3-pin & 8-pin recept
	34P65145A40	DIAL SCALE & BRKT: UHF
	76C66210A06	CORE, iron: T-500
	5K754071	GROMMET, insul (UHF tuner mtg)
	5S10115A04	GROMMET, rubber: .437 I.D. (HV shield; yoke leads)
	5A741077	GROMMET, strain relief: second anode lead
	14D67172A20	INSULATOR, control mtg (R & G drive)
	14D67172A21	INSULATOR, control mgt (focus, V center & H center)
	14B65732A07	INSULATOR, connector (use with 29D67429A04 lug)
	14B65732A04	INSULATOR, lug (use with 9C66402A04 lug)

Ref. No.	Part Number	Description
	14B754181	INSULATOR, molded cup: V-13 socket
	29A739899	LUG, terminal: for speaker & antenna leads
	29D67429A04	LUG, terminal: (blu, blk & brn jumpers on convergence panel)
	9C66402A04	LUG, terminal: for .206 wide lug
	9C66402A05	LUG, terminal: (pincushion assem leads)
	9C66402A03	LUG, terminal: spark gap ground wire
	59D68009A01	MAGNET, blue lateral & purity ring
	76D66816A06	MAGNET, radial: static conv
	2C720979	NUT, coil mtg: L-700
	2S7051	NUT, hex control mtg 3/8-32
	2B66148A02	NUT, self-threading (T-500 core)
	2S10054A14	NUT, spring: clip-on (yoke mtg ring)
	2S132377	NUT, wing: 6-32 (conv coil)
	1V66542A58	PLATE CAP ASSEM: incls coil & lead - V-11)
	23K743342	PLUG, line cord: AC interlock (USE 28A736068)
	28C67679A02	PLUG, molded: 12-pin; convergence coil assem
	28K749501	PLUG, 1-pin (UHF to VHF cable)
D	42C67369A01	RETAINER, gear
	47C66082A02	ROD, adjust (horiz hold)
	3S132346	SCREW, mach: 6-32 x 2-1/8 (conv coil)
	3S134277	SCREW, tpg: 6-18 x 1-1/4" lg (yoke mtg ring)
	43K754432	SLEEVE, UHF & VHF dial light (ANTS, NTS & PTS-A914)
	9V66550A34	SOCKET, CRT: incls leads
	9D66770A09	SOCKET, 12-pin molded (V-13 - USE 9D66770A05)
	9K749378	SOCKET, transistor (for Q-701 & Q-702)
	9D66770A10	SOCKET, tube: 12-pin molded (V-11)
	9D66770A12	SOCKET, tube: 9-pin molded (V-12)
	9K470425	SOCKET, tube: 9-pin molded (V-15 - USE 9K702428)
	9C66296A07	SOCKET, tube: 9-pin wafer type; less center shield (USE 9C6629A08)
	9C66296A08	SOCKET, tube: 9-pin wafer type; with center shield
	9C66609A11	SOCKET, tube: 7-pin wafer type; with center shield
	•9S10143A12	SOCKET, pilot lamp: incls brkt
	9D66770A05	SOCKET, 12-pin: conv brkt
	1A67478A01	SPARK GAP ASSEMBLY: focus supply
	2C65722A06	SPEED NUT, clip-on: HV shield
	41C65987A01	SPRING, CRT aquadag ground
	41A67281A01	SPRING, retainer (CRT shield mtg)
	41C66795A02	SPRING, retaining (radial magnet static convergence)
	41A67320A01	SPRING, wire (blue lateral coil mtg - ANTS, PTS & NTS-A914 only)
	41A67955A01	SPRING, yoke support
	29A731948	TERMINAL: open ring (purity magnet ground wire)

VHF TUNER - OPTT, LOPTT & ALOPTT-399

Ref. No.	Part Number	Description
ELECTRICAL PARTS		
CAPACITORS - NOTE: The capacitors in this list are recommended replacement types for the original equipment; all are ceramic disc type unless otherwise specified.		
C-1	21S410036	100 pf 10% 500V N750
C-2	21S124946	27 pf 5% 500V N470
C-3	•21S180C26	43 pf 5% 500V N470
C-4	21S132293	.001 mf +100-20% 500V
C-5	21S124946	27 pf 5% 500V N470
C-6	21S132144	30 pf 5% 500V N750
C-8	21S131104	12 pf 5% 500V N470
C-9	21S132925	.001 mf feed-thru
C-10	21S132925	.001 mf feed-thru
C-11	21S129761	2.2 pf 5% 500V GIM
C-12	21S132925	.001 mf feed-thru
C-13	21S134221	47 pf 5% feed-thru
C-15	21S132793	1.6 pf 10% 500V GIM
C-16	21S134220	33 pf 5% feed-thru
C-17	21S132293	.001 mf +100-20% 500V
C-18	21S132925	.001 mf +100-20% 500V
C-19	21S470326	2 pf ± .25 pf 500V NPO
C-20	21S120656	15 pf 5% feed-thru
C-21	21S180A23	5.8 pf ± .25 pf 500V NPO
C-22	•21S135751	18 pf 3% 500V N220
C-23	21S132925	.001 mf feed-thru
C-24	21S132925	.001 mf feed-thru
C-25	21S125529	470 pf 20% 500V
C-26	21S132293	.001 mf +100-20% 500V
MISCELLANEOUS ELECTRICAL PARTS		
E-1	•24P65144A40	ANTENNA INPUT FILTER ASSEM: incls L-1, L-2, L-31, T-2, C-1, C-2, C-3 & C-5
E-2	•40P65144A41	ANTENNA WAFER ASSEM: incls L-9 thru L-13 & R-1
E-3	•40P65144A42	RF PLATE WAFER ASSEM: incls L-15 thru L-20 & R-3
E-4	•40P65144A43	MIXER GRID WAFER ASSEM: incls L-22 thru L-27, R-7 & R-10
E-5A	1P65121A40	OSCILLATOR ROTOR ASSEM: incls coils; less E-5B & E-5C
E-5B	•1P65144A46	PRE-SET SCREW ASSEM: incls gear head screws, spring & holder; less E-5A & E-5C
E-5C	47P65118A44	OSCILLATOR STATOR ASSEM: incls contacts; less E-5A & E-5B
E-6	•40P65144A44	SWITCH, UHF input: incls C-4 & L-4
E-7	•40P65144A45	SWITCH, UHF B+ & dial light
	•40P65144A87	SWITCH, leaf: channel stop skip switch
COILS & CHOKES		
L-4	•24P65144A38	COIL, UHF input: series
L-6	24P65118A92	COIL, hi band neutralizing: channel 7 - 13
L-8	24P65114A27	COIL, antenna wafer: channel 13
L-14	24P65115A76	COIL, RF plate: channel 13
L-21	24P65114A35	COIL, mixer grid wafer: channel 13
L-28	24P65118A81	COIL, master oscillator
L-30	•24P65144A39	COIL, mixer screen
TRANSFORMERS		
T-1	•24P65144A37	IF OUTPUT COIL
T-2	24P65118A90	BALUN COIL
MECHANICAL PARTS		
	•44P65144A48	GEAR, driven: 48 tooth nylon - on channel selector shaft (OPTT-399 only)
	•44P65144A49	GEAR, driver: metal; incls plate & bushing
C	44C67370A02	GEAR, idler
A	•44C67370A07	GEAR, VHF tuning: incl shaft (20TS-918 only)
AA	44C67370A06	GEAR, VHF tuning: incl shaft (A22TS, 23TS-918)
	1V65120A46	IDLER GEAR ASSEM: engages fine tuning screws inside tuner
	2P65118A35	NUT, tinnerman: secures oscillator rotor to shaft
B	42C67369A01	RETAINER, gear
	3P65119A96	SCREW, fine tuning: gear head
	•47P65144A50	SHAFT, channel selector: incls detent wheel (OPTT-399)
	•47P65144A51	SHAFT, channel selector: incls detent wheel (LOPTT-399)
	•47P65144A88	SHAFT, channel selector: incls detent wheel (ALOPTT-399)
	•47P65144A52	SHAFT, fine tuning (LOPTT & ALOPTT-399)
29	•26A68338A01	SHIELD, VHF light
	41P65120A43	SPRING, bias: retains shaft on front plate
	41P65120A39	SPRING, detent and shaft grounding
	42P65120A38	SPRING, fine tuning shaft retainer (LOPTT & ALOPTT-399)
	4P65114A53	WASHER, "C": secures fine tuning gear (OPTT-399)
	77D68159B01	VHF TUNER, OPTT-399Y: complete
	77D68159A02	VHF TUNER, LOPTT-399Y: complete
	77D68159A03	VHF TUNER, ALOPTT-399Y: complete

UHF TUNER - HTT-624

Ref. No.	Part Number	Description
ELECTRICAL PARTS		
C-1	---	TUNING GANG (not replaceable)
C-2	•21P65144A68	1000 pf feed-thru
C-3	•21P65144A69	24 pf feed-thru
C-4	•21P65144A70	10 pf N150
E-1	48C742970	DIODE, crystal
Q-1	48P65123A67	TRANSISTOR
L-1	•24P65144A66	ANTENNA COUPLING ASSEM: incls terminals, coil, board and R-8
L-2	•24P65144A65	IF coil
L-3	•24P65144A64	EMITTER coil
MECHANICAL PARTS		
	•77P65144A67	UHF TUNER, TT624: less drive assem and anti-backlash gear
	44P65127A55	ANTI-BACKLASH GEAR & CLUTCH: incl lever tension spring
	•15P65144A60	COVER, osc section
	•15P65144A59	COVER, tuner
	•47P65144A62	DRIVE ASSEM & PLATE: incls mtg screws (less backlash gear)
	•14P65144A61	INSULATOR, stand off (trans base)
	•9P65144A71	RECEPTACLE, 1 pin
	3P65112A67	SCREW & LOCKWASH: 6-32-3/8 (drive assem mtg)
	•41P65112A35	SPRING, cover retaining
	•41P65144A63	SPRING, lever tension

UHF TUNER - TT-625

Ref. No.	Part Number	Description
ELECTRICAL PARTS		
CAPACITORS - NOTE: The capacitors in this list are recommended replacement types for the original equipment; all are ceramic disc type unless otherwise specified.		
C-1	---	TUNING GANG (not replaceable)
C-2	•21P65144A76	24 pf feed-thru
C-3	•21P65144A77	10 pf
C-4	•21P65177A78	470 pf feed-thru
C-5	•21P65144A79	100 pf feed-thru
E-1	48P65112A73	DIODE, mixer
L-2	•24P65144A74	IF coil
L-4	•24P65144A73	EMITTER coil
Q-1	•48P65144A72	TRANSISTOR (S-1019)
MECHANICAL PARTS		
20	43K471633	BEARING, ball: clutch release (10 required) & worm gear shaft (2 required)
18	•43B42738A01	BUSHING, tuning shaft (UHF)
4	1A562758	CLUTCH & DISC ASSEM: incls set screw
	•34P65145A40	DIAL SCALE & BRKT, UHF (plastic)
	•1U43500A14	DRIVE, PUSHBUTTON ASSEM.COMPL: incls pushbuttons, pointer, gear clutch & bushing, clutch & disc assem
19	44B42707A01	GEAR, clutch face
1	44A42702A01	GEAR, drive: manual fine tuning
9	•44A40680B01	GEAR, driven, on UHF shaft (metal)
2	44B40465B01	GEAR, idler
3	1B42770A02	GEAR & SHAFT ASSEM: incls worm & dog gear
28	45A41254A01	LINK, connecting
12	•52B40460B01	POINTER & ARM ASSEM:
11	•38C40473B01	PUSHBUTTON
6	----	ROCKER GEAR (not replaceable)
10	49A562480	ROLLER, clutch release
4A	3A563128	SCREW, set (clutch & disc assem - part of 4)
5	1V562830	SCREW & NUT ASSEM: adjustable
17	•47B42734A01	SHAFT, manual tuning (UHF)
16	41A562449	SPRING, anti-rattle
21	41A562447	SPRING, clutch release
27	41A41255A01	SPRING, link
25	41A562448	SPRING, plunger (5 used)
24	41B41805A01	SPRING, pointer tension
26	41A562446	SPRING, release bar (5 used)
	77D67691A06	UHF TUNER TT-625: complete
23	4A562430	WASHER, armite: clutch release
15	•4K646438	WASHER, "C", idler gear shaft (USE 4K692188)
14	4K501364	WASHER, "C"; manual fine tuning, shaft retaining
13	4K692188	WASHER, "C": pointer
22	4A562431	WASHER, cup: clutch release

UHF TUNER - HTT-627

Ref. No.	Part Number	Description
ELECTRICAL PARTS		
C-1	---	TUNING GANG (not replaceable)
C-2	21P65112A06	18 pf 10% 500V cer disc
C-3	20S10123A05	1-5 pf trimmer
C-4	21R134242	2.2 pf ± .1 pf N470 cer tubular
C-5	21P65112A05	1000 pf feed-thru
C-6	---	TRIM TAB (not furnished)
E-1	48C742970	DIODE, crystal (1N82A)
L-1	24P65112A08	ANTENNA COUPLING ASSEM: incls terminals & R-1
L-2	24P65112A11	COIL, IF output
L-3	---	COIL, injection (not furnished)
Q-1	48P65123A67	TRANSISTOR, special
MECHANICAL PARTS		
	44P65127A55	ANTI-BACKLASH GEAR & CLUTCH ASSEM: incls lever tension spring
	43A754070	BUSHING, mtg (UHF tuner)
	4765144A62	DRIVE ASSEM & PLATE: incls mtg screws
	5K754071	GROMMET, insulation (UHF tuner mtg)
	14P65112A66	INSULATOR, stand-off (transistor base)
	9P65112A33	RECEPTACLE, 1-pin
	4S7650	SCREW, interlock: 6-32 x 3/8" (drive assem mtg)
	41P65123A68	SPRING, cover retaining
	41P65112A36	SPRING, lever tension
	77P65123A91	UHF TUNER, TT-627: less drive assem, anti-backlash gear, spring & clutch

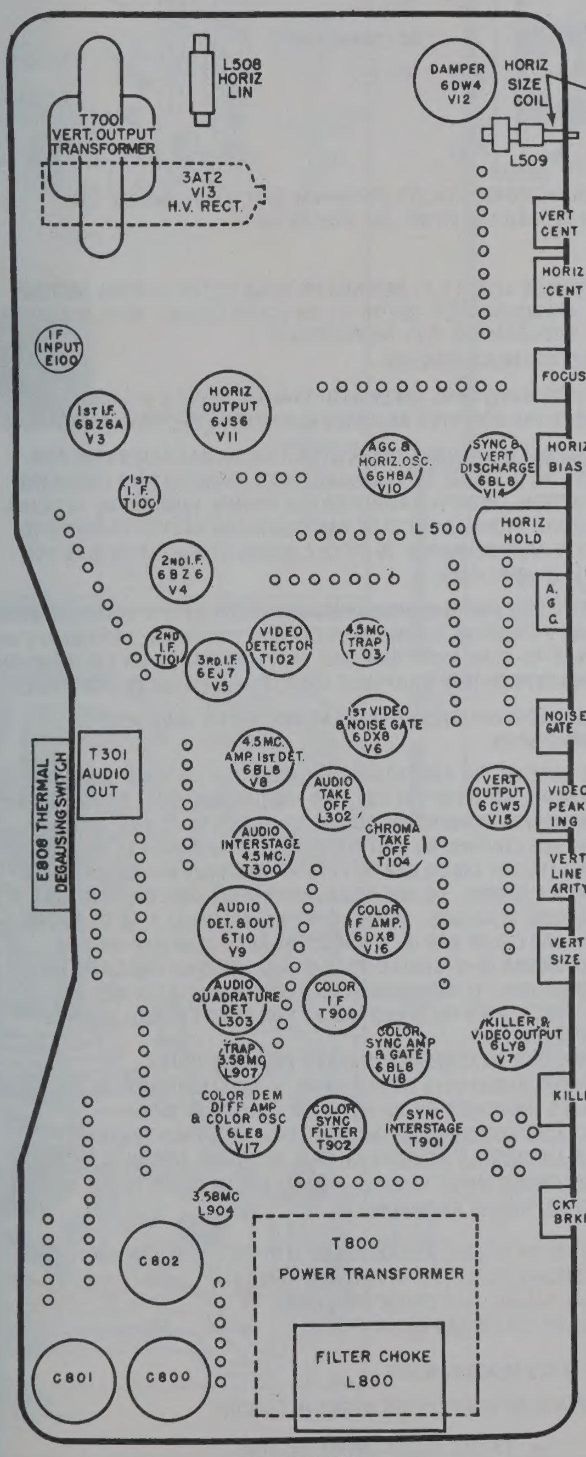
NOTE: If the displacement of the blue line is not equal on both ends with respect to R-G line, readjust blue horizontal tilt control (Step #12).

Repeat Steps #12, #13 and #14, if necessary, to get a satisfactory convergence along a center horizontal line or to get equal displacement to permit correction with the disc magnets.

15. Re-check disc magnets. The pattern should now be converged.

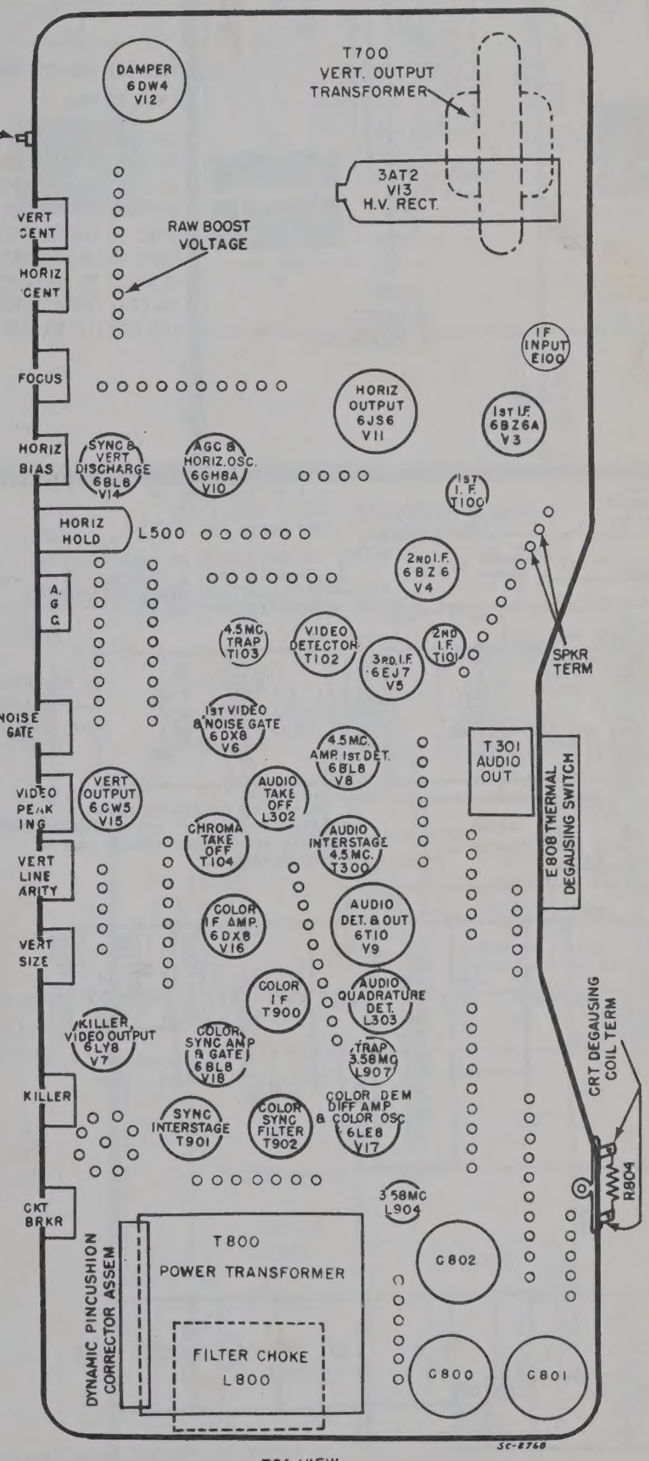
The G-2 controls should now be reset for a white background. Generally, since the blue G-2 is the only one disturbed, it is possible to set this control at its proper adjustment at low brightness while observing a local station.

If the purity ring is re-adjusted for any reason, the entire convergence procedure must be repeated.



L508
HORIZ
LIN
T700
VERT. OUTPUT
TRANSFORMER
3AT2
V13
H.V. RECT.
DAMPER
6DW4
V12
HORIZ
SIZE
COIL
L509
VERT
CENT
HORIZ
CENT
FOCUS
IF
INPUT
E100
HORIZ
OUTPUT
6JS6
V11
1st I.F.
6BZ6A
V3
AGC & HORIZ.OSC.
6GH8A
V10
SYNC & VERT DISCHARGE
6BL8
V14
HORIZ
BIAS
1ST
I. F.
T100
L500
HORIZ
HOLD
2ND I.F.
6BZ6
V4
A.
G.
C.
2ND
I.F.
T101
3RD I.F.
6EJ7
V5
VIDEO
DETECTOR
T102
4.5MC
TRAP
T 03
1ST VIDEO
& NOISE GATE
6DX8
V6
NOISE
GATE
T301
AUDIO
OUT
E808 THERMAL
DEGAUSSING SWITCH
4.5MC.
AMP. 1st DET.
6BL8
V8
AUDIO
TAKE
OFF
L302
VERT
OUTPUT
6CW5
V15
VIDEO
PEAK
ING
AUDIO
INTERSTAGE
4.5MC.
T300
CHROMA
TAKE
OFF
T104
VERT
LINE
ARITY
AUDIO
DET. & OUT
6T10
V9
COLOR
IF AMP.
6DX8
V16
VERT
SIZE
AUDIO
QUADRATURE
DET
L303
COLOR
I F
T900
TRAP
3.58MC
L907
COLOR
SYNC AMP
& GATE
6BL8
V18
KILLER &
VIDEO OUTPUT
6LY8
V7
KILLER
COLOR DEM
DIFF AMP
& COLOR OSC
6LE8
V17
COLOR
SYNC
FILTER
T902
SYNC
INTERSTAGE
T901
3.58MC
L904
CKT
BRKR
C802
T800
POWER TRANSFORMER
FILTER CHOKE
L800
C801
C800

BOTTOM VIEW



DAMPER
6DW4
V12
T700
VERT. OUTPUT
TRANSFORMER
3AT2
V13
H.V. RECT.
VERT
CENT
RAW BOOST
VOLTAGE
HORIZ
CENT
IF
INPUT
E100
FOCUS
HORIZ
OUTPUT
6JS6
V11
1st I.F.
6BZ6A
V3
HORIZ
BIAS
SYNC & VERT DISCHARGE
6BL8
V14
AGC & HORIZ.OSC.
6GH8A
V10
1ST
I. F.
T100
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2ND I.F.
6BZ6
V4
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4.5MC
TRAP
T103
VIDEO
DETECTOR
T102
3RD I.F.
6EJ7
V5
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I.F.
T101
SPKR
TERM
NOISE
GATE
1ST VIDEO
& NOISE GATE
6DX8
V6
4.5MC.
AMP. 1st DET.
6BL8
V8
T301
AUDIO
OUT
E808 THERMAL
DEGAUSSING SWITCH
VIDEO
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6CW5
V15
AUDIO
TAKE
OFF
L302
CHROMA
TAKE
OFF
T104
AUDIO
INTERSTAGE
4.5MC.
T300
VERT
LINE
ARITY
COLOR
IF AMP.
6DX8
V16
AUDIO
DET. & OUT
6T10
V9
VERT
SIZE
COLOR
I F
T900
AUDIO
QUADRATURE
DET.
L303
KILLER &
VIDEO OUTPUT
6LY8
V7
COLOR
SYNC AMP
& GATE
6BL8
V18
TRAP
3.58MC
L907
CRT DEGAUSING
COIL TERM
KILLER
SYNC
INTERSTAGE
T901
COLOR
SYNC
FILTER
T902
COLOR DEM
DIFF AMP
& COLOR OSC
6LE8
V17
R804
3.58MC
L904
CKT
BRKR
T800
POWER TRANSFORMER
DYNAMIC PINCUSHION
CORRECTOR ASSEM
FILTER CHOKE
L800
C802
C800
C801
SC-2768

TOP VIEW

TECH-REVIEW TECH-REVIEW TECH-REVIEW
TECH-REVIEW TECH-REVIEW TECH-REVIEW
TECH-REVIEW TECH-REVIEW TECH-REVIEW

MOTOROLA technical product information

BULLETIN: DB-30

February 27, 1967

SUBJECT: Service Experiences - Color Television

The following service experiences have been reported from the field.

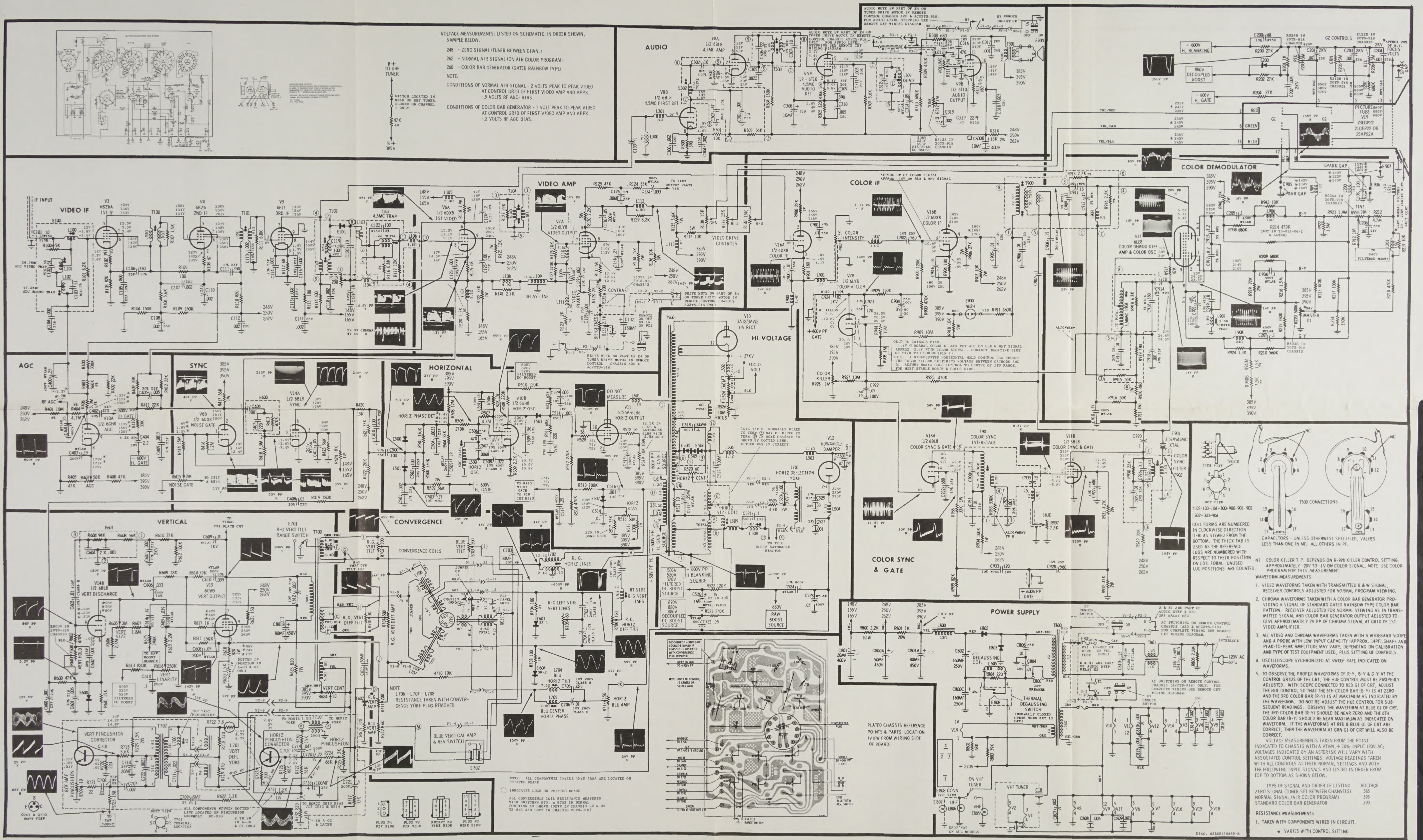
This represents some of the information passed on by Motorola Regional Service Managers and Motorola Distributor Service Managers at regular service meetings and also by Motorola Technical Trainers in their daily calls on dealers to provide individual personalized service training.

SERVICE EXPERIENCES - COLOR TV CHASSIS TS-914, TS-A914, TS-918

REF. NO.	SYMPTOM	SOLUTION
VIDEO		
1.	No UHF.	Open diode, E-1.
2.	No UHF.	Open cable connecting UHF tuner with VHF tuner. Can be intermittent and may not act up until set is warm.
3.	Snow, AGC trouble, Intermittent Video, loss of color.	Open cable from VHF tuner to chassis is usually intermittent and acts up after set is warm. Cables that are black in color can cause this trouble.
4.	No video, brightness O.K.	Open R-115, 200 ohm control in secondary of T-102. Short across with screwdriver to check.
5.	No video, brightness O.K.	Open L-104 choke, short across with screwdriver to check.
6.	No video, brightness low.	R-135, 5.6K, 7 watt resistor open.
7.	Picture overloads or blanks out when changing channels. AGC control action not normal.	Change 3rd IF tube V-5, 6EJ7.
BRIGHTNESS		
8.	Low brightness.	L-105 open, voltage on plate of V-6A low, but not zero. Voltage is fed from Noise Gate circuit to operate V-6A.
9.	Low brightness.	Open L-108 peaking coil.
10.	Low brightness.	Open L-109 delay line.
11.	Low brightness.	Defective V-7A 6LY8 video output tube or 6DX8 1st video.
12.	Low brightness.	Contrast control R-132, should be 200 ohms. More than 30 ohms higher will reduce brightness.

Motorola Consumer Products Inc., 9401 w. grand ave., franklin park, ill.

MOTOROLA COLOR TV CHASSIS 20, A20, 22, A22, AC22 & 23TS-918 A-00 THRU A-05



VOLTAGE MEASUREMENTS: LISTED ON SCHEMATIC IN ORDER SHOWN, SAMPLE BELOW.

248 - ZERO SIGNAL (TUNER BETWEEN CHAN.)

262 - NORMAL AIR SIGNAL (ON AIR COLOR PROGRAM)

260 - COLOR BAR GENERATOR (GATED RAINBOW TYPE)

NOTE:

CONDITIONS OF NORMAL AIR SIGNAL - 2 VOLTS PEAK TO PEAK VIDEO AT CONTROL GRID OF FIRST VIDEO AMP AND APPX. -.5 VOLTS RF AGC: BIAS.

CONDITIONS OF COLOR BAR GENERATOR - 1 VOLT PEAK TO PEAK VIDEO AT CONTROL GRID OF FIRST VIDEO AMP AND APPX. -.2 VOLTS RF AGC BIAS.

T102-103-104-300-900-901-902

L302-303-904

COIL FORMS ARE NUMBERED IN CLOCKWISE DIRECTION (1-8) AS VIEWED FROM THE BOTTOM. THE THICK TAB IS USED AS THE REFERENCE. LUGS ARE NUMBERED WITH RESPECT TO THEIR POSITION ON COIL FORM. UNUSED LUG POSITIONS ARE COUNTED.

CAPACITORS - UNLESS OTHERWISE SPECIFIED, VALUES LESS THAN ONE IN MF: ALL OTHERS IN PF.

N1 COLOR KILLER T.P. DEPENDS ON R-928 KILLER CONTROL SETTING: APPROXIMATELY -20V TO -1V ON COLOR SIGNAL. NOTE: USE COLOR PROGRAM FOR THIS MEASUREMENT

WAVEFORM MEASUREMENTS:

1. VIDEO WAVEFORMS TAKEN WITH TRANSMITTED B & W SIGNAL, RECEIVER CONTROLS ADJUSTED FOR NORMAL PROGRAM VIEWING.
2. CHROMA WAVEFORMS TAKEN WITH A COLOR BAR GENERATOR PROVIDING A SIGNAL OF STANDARD GATED RAINBOW TYPE COLOR BAR PATTERN. RECEIVER ADJUSTED FOR NORMAL VIEWING AS IN TRANSMITTED SIGNAL AND COLOR BAR GENERATOR OUTPUT ADJUSTED TO GIVE APPROXIMATELY 2V PP OF CHROMA SIGNAL AT GRID OF 1ST VIDEO AMPLIFIER.
3. ALL VIDEO AND CHROMA WAVEFORMS TAKEN WITH A WIDEBAND SCOPE AND A PROBE WITH LOW INPUT CAPACITY (APPROX. 14PF). SHAPE AND PEAK-TO-PEAK AMPLITUDE MAY VARY, DEPENDING ON CALIBRATION AND TYPE OF TEST EQUIPMENT USED, PLUS SETTING OF CONTROLS.
4. OSCILLOSCOPE SYCHRONIZED AT SWEEP RATE INDICATED ON WAVEFORMS.
5. TO OBSERVE THE PROPER WAVEFORMS OF R-Y, B-Y & G-Y AT THE CONTROL GRIDS OF THE CRT, THE HUE CONTROL MUST BE PROPERLY ADJUSTED. WITH SCOPE CONNECTED TO RED G1 OF CRT, ADJUST THE HUE CONTROL SO THAT THE 6TH COLOR BAR (B-Y) IS AT ZERO AND THE 3RD COLOR BAR (R-Y) IS AT MAXIMUM AS INDICATED BY THE WAVEFORM. DO NOT RE-ADJUST THE HUE CONTROL FOR SUBSEQUENT READINGS. OBSERVE THE WAVEFORM AT BLUE G1 OF CRT. THE 3RD COLOR BAR (R-Y) SHOULD BE NEAR ZERO AND THE 6TH COLOR BAR (B-Y) SHOULD BE NEAR MAXIMUM AS INDICATED ON WAVEFORM. IF THE WAVEFORMS AT RED & BLUE G1 OF CRT ARE CORRECT, THEN THE WAVEFORM AT GRN G1 OF CRT WILL ALSO BE CORRECT.

VOLTAGE MEASUREMENTS TAKEN FROM THE POINT INDICATED TO CHASSIS WITH A VTVM, + 10%; INPUT 120V AC; VOLTAGES INDICATED BY AN ASTERISK WILL VARY WITH ASSOCIATED CONTROL SETTINGS; VOLTAGE READINGS TAKEN WITH ALL CONTROLS AT THEIR NORMAL SETTINGS AND WITH THE FOLLOWING INPUT SIGNALS AND LISTED IN ORDER FROM TOP TO BOTTOM AS SHOWN BELOW.

TYPE OF SIGNAL AND ORDER OF LISTING.	VOLTAGE
ZERO SIGNAL (TUNER SET BETWEEN CHANNELS)	385
NORMAL SIGNAL (AIR COLOR PROGRAM)	395
STANDARD COLOR BAR GENERATOR	390

RESISTANCE MEASUREMENTS

1. TAKEN WITH COMPONENTS WIRED IN CIRCUIT.

* VARIES WITH CONTROL SETTING

TECH-REVIEW TECH-REVIEW TECH-REVIEW
TECH-REVIEW TECH-REVIEW TECH-REVIEW
TECH-REVIEW TECH-REVIEW TECH-REVIEW

MOTOROLA technical product information

BULLETIN: DB-30 February 27, 1967

SUBJECT: Service Experiences - Color Television

The following service experiences have been reported from the field.

This represents some of the information passed on by Motorola Regional Service Managers and Motorola Distributor Service Managers at regular service meetings and also by Motorola Technical Trainers in their daily calls on dealers to provide individual personalized service training.

SERVICE EXPERIENCES - COLOR TV CHASSIS TS-914, TS-A914, TS-918

REF. NO.	SYMPTOM	SOLUTION
VIDEO		
1.	No UHF.	Open diode, E-1.
2.	No UHF.	Open cable connecting UHF tuner with VHF tuner. Can be intermittent and may not act up until set is warm.
3.	Snow, AGC trouble, Intermittent Video, loss of color.	Open cable from VHF tuner to chassis is usually intermittent and acts up after set is warm. Cables that are black in color can cause this trouble.
4.	No video, brightness O.K.	Open R-115, 200 ohm control in secondary of T-102. Short across with screwdriver to check.
5.	No video, brightness O.K.	Open L-104 choke, short across with screwdriver to check.
6.	No video, brightness low.	R-135, 5.6K, 7 watt resistor open.
7.	Picture overloads or blanks out when changing channels. AGC control action not normal.	Change 3rd IF tube V-5, 6EJ7.
BRIGHTNESS		
8.	Low brightness.	L-105 open, voltage on plate of V-6A low, but not zero. Voltage is fed from Noise Gate circuit to operate V-6A.
9.	Low brightness.	Open L-108 peaking coil.
10.	Low brightness.	Open L-109 delay line.
11.	Low brightness.	Defective V-7A 6LY8 video output tube or 6DX8 1st video.
12.	Low brightness.	Contrast control R-132, should be 200 ohms. More than 30 ohms higher will reduce brightness.

PART NO. 68P65139A14

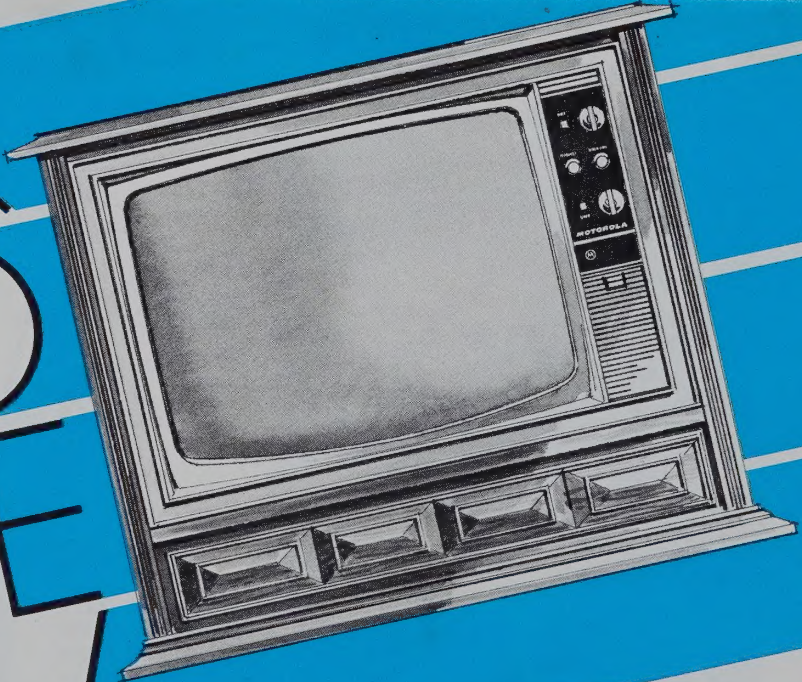
REF. NO.	SYMPTOM	SOLUTION
13.	Contrast control works like brightness control.	Capacitor C-132 shorted, or lead to center tap of control shorted to ground.
14.	Color missing in Black & White picture. (Set will not track.)	Open drive control (R-138, R-139 or R-140)
15.	Low brightness.	Check value of R-224; connected from arm to ground of master G-1 control. If value is 47K ohm, change to 150K.
16.	Excessive brightness no control.	Shorted or gassy V-7A 6LY8 video output tube.
17.	Picture shifts with brightness setting.	Open diode, either E-504, E-505 or E-506.
18.	No brightness or sound, high voltage O.K.	Open R-801, 1K 20 watt resistor, due to CRT filiment wire shorted to a tube shield.
19.	Smeared B-W Picture.	Open C-127 .5mfd 100V.
COLOR		
20.	No color, normal B-W. May also be very weak color.	Open T-104, check solder connections.
21.	Weak color.	Open L-900, L-901, L-902, T-900 - 6DX8 Color IF.
22.	No color, normal B-W.	Cable to color intensity control shorted, due to laying against tube.
23.	Frequent re-setting of color killer control.	Color Killer improperly adjusted. Leaking of C-922 capacitor. Also low oscillator injection. Realign color sync.
24.	Color light flicker. (Changing of killer switching voltage.)	R-925, 15 meg resistor located under 4 watt resistor. Dress away from 4 watt resistor. Check R-925 should be 15 meg.
25.	Color fades, weak, or color light flickers.	Bad 6DX8 Color IF tube. Check voltage which controls killer tube. If voltage rise is not enough re-align T-902 & L-904 as per service manual.
26.	No color, Green screen.	Shorted T-900 transformer (Color IF assembly) This will show up in a high voltage on Pins 2 & 7 of V-17 6LB8.
27.	Weak color.	C-907 dressed too close to the ground side of either C-910, or C-908. Re-dress away from them.
28.	Green screen.	Oscillator coil bad, L-904.
29.	Green screen.	Open E-901, 3.58 Xtal; R-940 changes value or opens.
30.	No color sync.	Open T-902 transformer (re-heat solder connections) Defective R-932 and R-931. Recheck color sync alignment.
31.	Hue control inoperative (with flesh tones.)	Shorted cable to hue control.
32.	Hue control inoperative.	V-18B 6BL8 tube shorted.
33.	Flesh tones not in the center of hue control.	Readjust T-901, and/or T-900.
HORIZONTAL & HIGH VOLTAGE		
34.	No high voltage 6JS6 and 6DW4 tubes running red.	Early TS-914, 3rd IF tube, 6EJ7 shorts, 160 volt supply that feeds tube also feeds horizontal oscillator tube and stops it's operation. C-520 leaky, C-708 leaking. Also shorted 3AT2. R-522 over heated, change to 1 watt. Wrong value of R-519 (See REF. NO. 38)

REF. NO.	SYMPTOM	SOLUTION
35.	No focus.	R-524 resistor changes value.
36.	Excessive width.	Early TS-914 had no width coil. This coil can be ordered as a field installed kit, Part Number 24P65142A75.
37.	Narrow white band around 23" CRT.	This is due to over scan of the screen, adjust horizontal and vertical size controls.
38.	Excessive 6JS6 failure.	Check E-502 or E-503, could be shorted. Change screen resistor R-519 from 10K to 12.5K, 10 watt. (This resistor is located on top of chassis next to 6JS6 tube.)
39.	No high voltage - 6JS6 or 6DW4 gets hot.	Open E-503 - open horizontal oscillator coil. Shorted C-708 in pincushioning circuit. Open - pin 2 on V-11 - shorted C-528.
AGC & SYNC		
40.	AGC trouble.	6DX8 tube V-6 low emmission.
41.	Set overloads, AGC control very critical.	Shorted E-502 regulator, or shorted C-700, .lmfd in pincushion circuit. Check and see if horizontal bias control has an effect on the high voltage, or if Snivets are in UHF.
42.	No sync, or intermittent sync.	Open or shorted E-400 resistor capacitor.
43.	No vertical sync.	Shorted E-600 in cathode of vertical oscillator.
VERTICAL		
44.	Vertical size shrink with brightness.	TS-914 only. Change 6JS6 to 6JS6A tube and take network off of pin 10 of 6JS6 and ground pin 10.
45.	Vertical size change.	C-605, .039 capacitor leaking.
46.	Vertical retrace lines (varies with contrast control setting)	C-400, or C-401, .25 capacitor in AGC open.
47.	Intermittent vertical.	Check pincushion corrector plug. (Enlarged holes)
48.	Small vertical.	Open C-611, 50mfd at 150V (located on top of chassis.)
49.	Picture stretched at top, compressed at bottom, out of convergence badly.	Shorted C-611, 50mfd at 150V (located on top of chassis.)
SOUND		
50.	Low volume.	Shorted 6T10 tube R-313 and T-301 over heats, (primary shorts.)
51.	No sound or intermittent sound.	Re-heat solder connections on T-300 or shorted T-301.
52.	No sound or intermittent sound.	Re-heat solder connections on L-303 or L-302.
CONVERGENCE		
53.	No blue convergence.	Open ground connection on T-500.
54.	No blue horizontal convergence, sometimes intermittent.	Open C-706, .01 capacitor.
55.	Pops in, out of convergence, intermittent.	Re-heat solder connection on either C-701 or C-705, on convergence board. Also check plugs to convergence board.
56.	Poor vertical convergence.	T-700, vertical output transformer, convergence winding open.

REF. NO.	SYMPTOM	SOLUTION
57.	Red, green, blue vertical amplitude controls no effect.	Shorted C-611, 50mfd at 150V. Shorted to chassis through metal clip that holds it. (Mounted on top of chassis.)
PURITY		
58.	Purity hard to set, or will not stay in adjustment.	Check the four ears on the front yoke clamp. (Firmly stuck, and clamp is centered.) If this clamp is loose or miscentered the yoke will likely misalign horizontally with the neck of the CRT, thus making it difficult to set purity and the yoke position may shift with use.
59.	Poor purity.	Could be caused by a defective degaussing switch, E-808.
60.	B+ short, trips circuit breaker.	E-808 automatic degaussing switch shorted to case.
61.	Small picture, color bands in picture, out of focus, B++ about 100 volts low.	E-808 automatic degaussing switch open.
62.	Circuit breaker blows after 10 or 20 minutes.	E-800 bad. (Replace with new type, orange button.)
63.	Open CRT filaments.	Remove any by-pass capacitors in the CRT filament circuit. When replacing a CRT for open filament always check for these capacitors.
64.	R-802 burned open, no defect seen in the set.	Wire from 385V supply lying across terminal strip, placing 385V at this point.
65.	R-803 burned open, no defect seen in the set.	Filament wire from chassis to CRT shorted to metal shield on a tube.
MISCELLANEOUS		
66.	Dead set. Circuit breaker blows as soon as set is turned on.	Shorted E-802, E-803 also L-800 choke grounds - open #31 fuse wire in primary of power transformer.
INTERFERENCE		
67.	920KC beat in picture.	Adjust T-103 as per service manual.
68.	3.58 in Picture.	Adjust L-907 as per service manual.
69.	High frequency, interference pattern, usually on lower right portion of screen only. Sometimes bands of thin horizontal black lines on the screen.	Caused by the vertical pincushion transistor oscillation. Add 33mmfd disc capacitor from base to emitter and 33mmfd from base to collector, or replace transistor.
70.	Gray vertical bars. (like color bar generator without color)	Defective E-901, 3.58 Xtal.
71.	Green line on left side of center of screen.	Defective E-200 horizontal blanking diode.

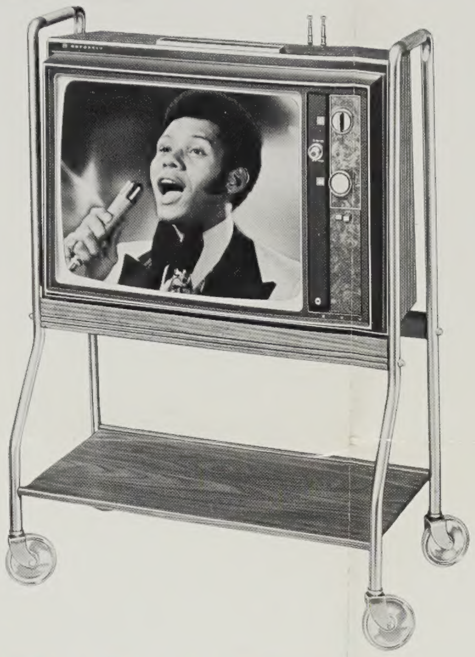
MOTOROLA

BLACK AND WHITE TV



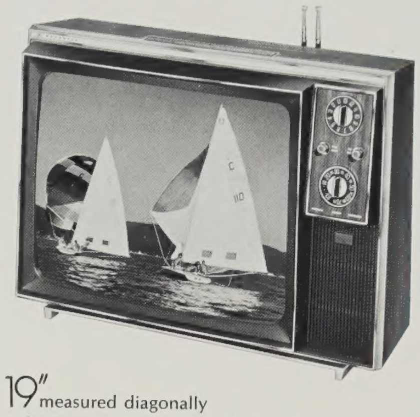
REF. NO.	SYMPTOM	SOLUTION
57.	Red, green, blue vertical amplitude controls no effect.	Shorted C-611, 50mfd at 150V. Shorted to chassis through metal clip that holds it. (Mounted on top of chassis.)
PURITY		
58.	Purity hard to set, or will not stay in adjustment.	Check the four ears on the front yoke clamp. (Firmly stuck, and clamp is centered.) If this clamp is loose or miscentered the yoke will likely misalign horizontally with the neck of the CRT, thus making it difficult to set purity and the yoke position may shift with use.
59.	Poor purity.	Could be caused by a defective degaussing switch, E-808.
60.	B+ short, trips circuit breaker.	E-808 automatic degaussing switch shorted to case.
61.	Small picture, color bands in picture, out of focus, B++ about 100 volts low.	E-808 automatic degaussing switch open.
62.	Circuit breaker blows after 10 or 20 minutes.	E-800 bad. (Replace with new type, orange button.)
63.	Open CRT filaments.	Remove any by-pass capacitors in the CRT filament circuit. When replacing a CRT for open filament always check for these capacitors.
64.	R-802 burned open, no defect seen in the set.	Wire from 385V supply lying across terminal strip, placing 385V at this point.
65.	R-803 burned open, no defect seen in the set.	Filament wire from chassis to CRT shorted to metal shield on a tube.
MISCELLANEOUS		
66.	Dead set. Circuit breaker blows as soon as set is turned on.	Shorted E-802, E-803 also L-800 choke grounds - open #31 fuse wire in primary of power transformer.
INTERFERENCE		
67.	920KC beat in picture.	Adjust T-103 as per service manual.
68.	3.58 in Picture.	Adjust L-907 as per service manual.
69.	High frequency, interference pattern, usually on lower right portion of screen only. Sometimes bands of thin horizontal black lines on the screen.	Caused by the vertical pincushion transistor oscillation. Add 33mmfd disc capacitor from base to emitter and 33mmfd from base to collector, or replace transistor.
70.	Gray vertical bars. (like color bar generator without color)	Defective E-901, 3.58 Xtal.
71.	Green line on left side of center of screen.	Defective E-200 horizontal blanking diode.

MOTOROLA
BIG SCREEN PORTABLES



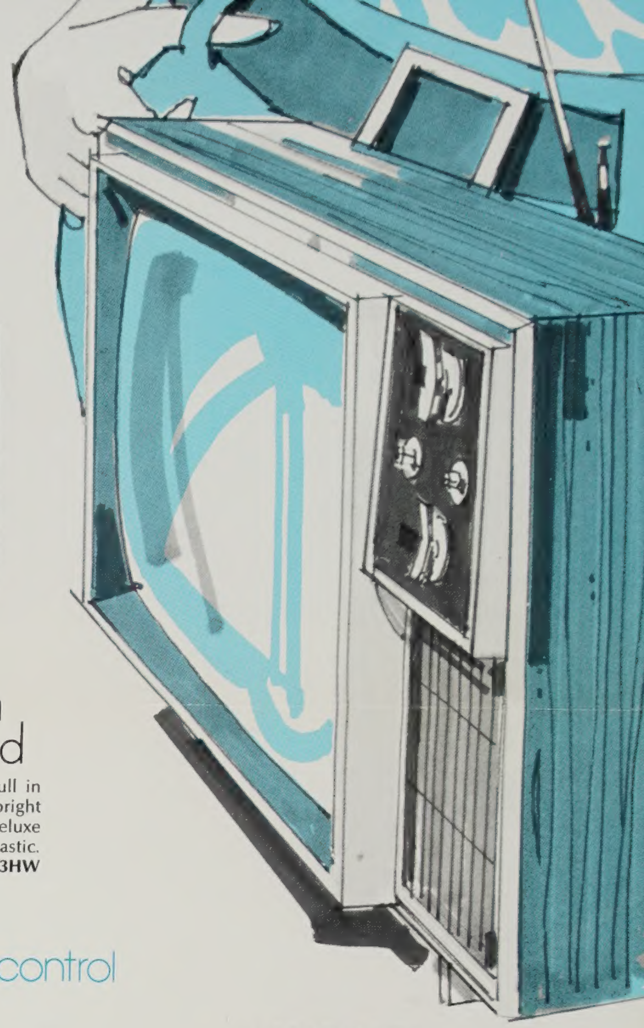
19" measured diagonally
ensemble TV with "quick-set" picture control

An ensemble big screen, big performer. Includes its own roll-about cart . . . "Quick-Set" picture control to help simplify secondary control operations . . . Instant picture and sound . . . Dipole VHF antenna . . . Private listening earphone. Handsome Walnut grain finished cabinet of high impact plastic. 16½" H, 22½" W, 13½" D.
Model BP535HW



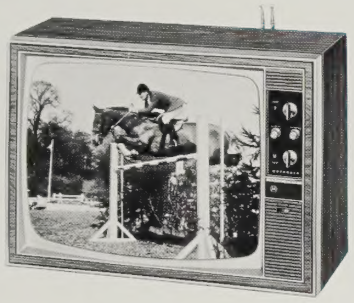
19" measured diagonally
deluxe portable TV with instant picture and sound

With a built-in dipole antenna system to help pull in a strong TV signal, you can enjoy a sharp, bright picture the moment you turn on the set. Deluxe Walnut grain finished cabinet of high impact plastic. 16½" H, 22½" W, 13½" D. **Model BP533HW**



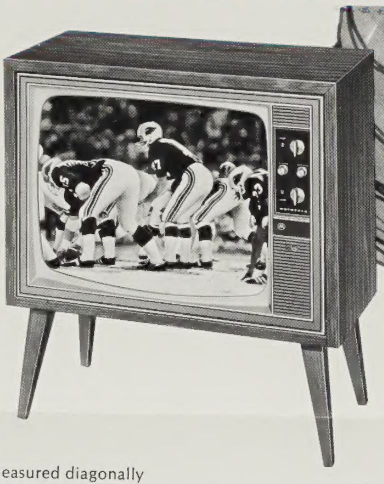
SOLID STATE BLACK & WHITE TV with QUICK-SET picture control

All pictures shown on screens simulate TV reception.



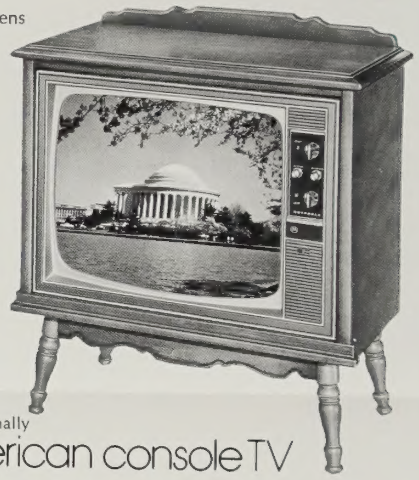
22" measured diagonally
deluxe table TV

Our biggest black and white TV picture size—282 square inches viewing area. The reliability of 100% solid state chassis—no tubes. "Quick-Set" picture control. Instant Picture and Sound. Many other outstanding features. Handsomely finished cabinet in Walnut grain on metal 18⅜" H, 25¾" W, 15⅞" deep. **Model XT778HW**



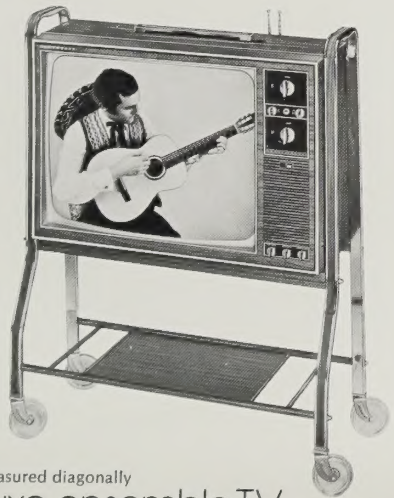
22" measured diagonally
contemporary console TV

Exceptional value. Our finest solid state chassis, fully featured, and our biggest black and white screen size—282 square inches—in a cabinet of Northern Walnut vinyl finish on wood materials. 27¼" W, 29⅜" H, 14¼" D. **Model XU779HW**



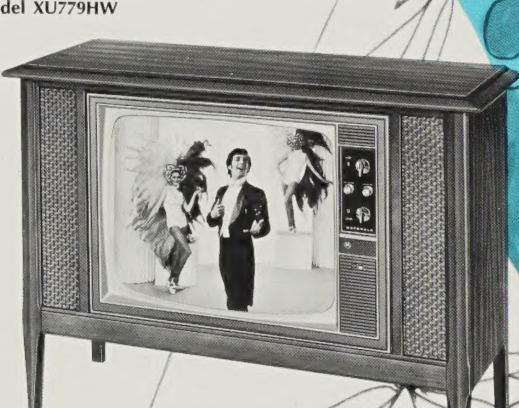
22" measured diagonally
early american console TV

Here's one of our finest. A solid state solid chassis, fully featured and biggest available black and white picture in a cabinet that reflects the warmth and charm of Colonial furniture. Genuine Birch veneers and select solids are finished in Brushed Glaze Maple. 29¼" W, 32⅛" H, 15¼" D. **Model XU781HS**



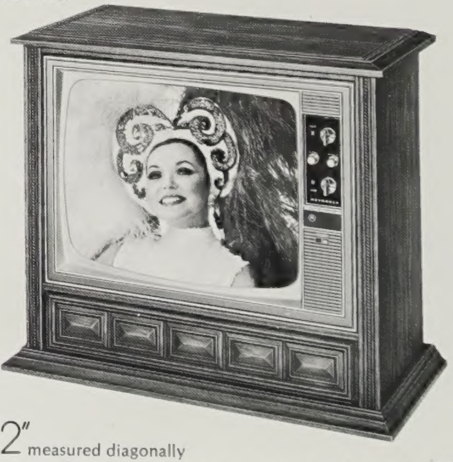
21" measured diagonally
deluxe ensemble TV

Move this ensemble about the house. The cart is included. Big 229 square inch picture . . . 100% solid state chassis—no tubes . . . plus outstanding "Quick-Set" picture control and Instant Picture and Sound. Handsome cabinet finished in Walnut grain vinyl on metal. 17⅞" H, 24⅛" W, 14¼" D. **Model XT630HW**



22" measured diagonally
contemporary console TV

Low in profile, this elegantly fashioned cabinet is finished in Oil Walnut on genuine Tiama Mahogany veneers and select solids. Features "Quick-Set" picture control, Instant Picture and Sound and many more outstanding features found in our solid state chassis models. 40" W, 29⅝" H, 15¾" D. **Model XL780HW**



22" measured diagonally
mediterranean credenza TV

Full-to-the-floor credenza design provides the accent to this fully-featured solid state black and white TV. A Moreno Oak finish on genuine Oak veneers and Oak solids provide bold Mediterranean styling with decorative detail in molded simulated wood materials. 31¾" W, 27⅝" H, 16" D. **Model XU782HK**

MOTOROLA
BLACK & WHITE TV FEATURES

ALL MODELS

Instant Picture and Sound—Your fingers hardly leave the on/off control before you hear sound and see a picture. (Except models BP309 and XP263.)

Custom-Matic Pre-Set VHF Tuner—You can select your channels and precision fine tune each to the best available signal. Once fine tuned it minimizes the need to fine tune again as you change from channel to channel.

Solid State UHF Tuner—Transistorized to minimize signal drifting when tuned to channels 14-83. Two speed tuning permits selection of channel quickly and then slowly fine tuning for best signal and picture.

Solid State High Voltage Rectifier—(Except models BP461H, BP533H, BP535H.) A reliable solid state rectifier replaces the tube type high voltage rectifier for improved power supply operation and long life performance.

3-Stage Video IF Amplification System—Utilizes three high gain amplifying components (two in models AP406, BP309 and BP318) to help maintain excellent contrast. Input filters help reject adjacent channel interference.

Gated Automatic Gain Control—Helps minimize picture interferences caused by varying signal strength as well as picture flutter caused by airplanes flying overhead.

Out-Front Motorola Golden Voice Speakers—For exceptional sound clarity, each set has a Motorola Golden Voice speaker. Most speaker sizes are 5 x 3", except Model XP263H—2¾", XP320G—3", BP318H and AP406H—3½ x 1¾", BP461—6 x 2".

"Quick-Set" Picture Control—One button adjusts contrast, brightness and vertical hold to help simplify operation of your TV set. (Models BP535 and all models with 21" and 22" diagonally measured picture.)

"Quick-Set" Indicator Light—When control is activated green light is on. Normal controls for brightness, contrast and vertical hold are inoperable to prevent tampering with pre-set picture quality.

SOLID STATE 21" and 22" MODELS
(measured diagonally)

Plug-In Mini-Circuits—Two tubeless mini-circuits plug-in and out for quick easy service . . . just like they do in Motorola Quasar Color TV. These mini-circuits contain most of the components and circuitry necessary for processing TV signals.

Integrated Circuit Audio System—An advanced micro-electronic solid state component replaces multiple components to provide improved reliability in the audio system.

CATV Circuitry—Special circuitry helps provide a steady picture when set is hooked up to a Community Antenna System.

Noise Gate Circuit—Especially helpful in maintaining a steady picture in high traffic areas where automobile ignition noise may cause interference.

Lighted Channel Indicators—Models XP320G, BP535H, XT630H, XT778H, XU779H, XL780H, XU781H and XU782H.

Earphone Jack—Models XP263H, BP318H, XP320G, AP406H, BP461H, BP535H and XT630H.

Roll-about Cart Included—Models BP535H and XT630H.

Sun Shield Included—Models XP263H, BP318H and XP320G.

GUARANTEE

portable black and white TV*

ONE YEAR GUARANTEE ON ALL COMPONENT PARTS
FREE 90-DAY CARRY-IN SERVICE

For ninety days from purchase date, Motorola guarantees to pay labor charges for correction of product defects. For one year from purchase date, Motorola guarantees to exchange all defective parts. Exchange made with remanufactured Motorola parts. Guarantee is effective only when carried to and serviced by a Motorola authorized servicer during normal working hours. Guarantee does not cover installation, set-up, travel time or mileage, antenna system, adjustment of customer controls, foreign use (except Canada) or damage due to owner misuse.

* including model XT630H

console black and white TV*

ONE YEAR GUARANTEE ON ALL COMPONENT PARTS

For one year from purchase date, Motorola guarantees to exchange all defective parts. Exchange made with remanufactured Motorola parts. Labor charges are not included in this guarantee. They are paid by the owner. Guarantee is effective only when serviced by a Motorola authorized servicer during normal working hours. Guarantee does not cover installation, set-up, travel time or mileage, antenna system, adjustment of customer controls, foreign use (except Canada) or damage due to owner misuse.

* including table model XT778H.

Motorola, M, Golden Voice, Custom-Matic, Quasar, and Quick-Set are trademarks of Motorola, Inc. Specifications subject to change without notice.

SUPPLEMENT NO. 2
TO TS-918A SERVICE MANUAL,
PART NO. 68P65135A77

television

MANUAL 68P65135A79

CHASSIS TS-918A

MODELS RT606C, CU622C

MOTOROLA

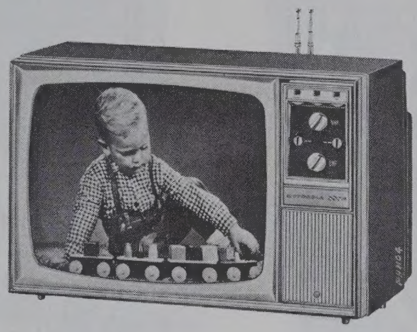
service manual

SUPPLEMENT NO. 2
TO TS-918A SERVICE MANUAL,
PART NO. 68P65135A77

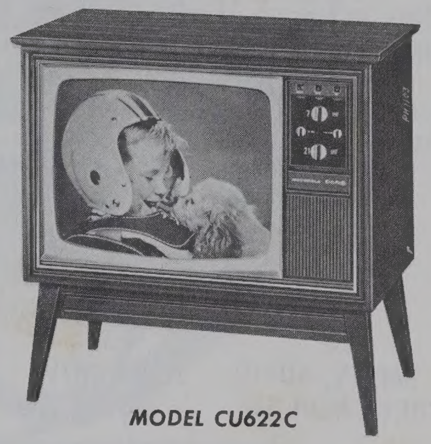
television MANUAL 68P65135A79
CHASSIS TS-918A
MODELS RT606C, CU622C

GENERAL INFORMATION

This supplement introduces two (2) new models previously not listed. Included is all information pertinent to the unique portions of these new models. Refer to the "Table of Contents" for type of information included. For all other information, refer to the original TS-918A Service Manual, Part Number 68P65135A77.



MODEL RT606C



MODEL CU622C

MODEL BREAKDOWN CHART

MODEL	CHASSIS	VHF TUNER	UHF TUNER	CRT	ADDITIONAL CHASSIS
RT606CN	A20TS-918	AOPTT-399	HTT-624 or HTT-627	21GFP22	*TRR-6 & TRT-5
CU622CW	20TS-918	OPTT-399	HTT-624 or HTT-627	21GFP22	-----

*TRR-6 - Remote Control Receiver

*TRT-5 - Remote Control Transmitter

For service information pertaining to the TRR-6 and TRT-5, refer to the original TS-918A Service Manual, Part Number 68P65135A77.

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UNIQUE REMOTE CONTROL REPLACEMENT PARTS LIST 7
VHF TUNER - AOPTT-399 - REPLACEMENT PARTS LIST 6

MOTOROLA INC. 9401 WEST GRAND AVENUE, FRANKLIN PARK, ILLINOIS
PART NO. 68P65135A79 12-66 PRICE 75 CENTS
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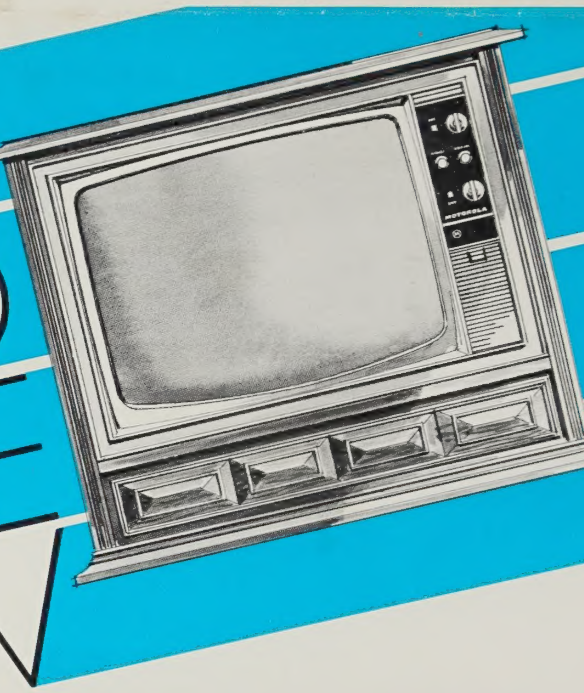
MOTOROLA

BLACK AND WHITE TV



GUARANTEE

portable black and white TV*

ONE YEAR GUARANTEE ON ALL COMPONENT PARTS
FREE 90-DAY CARRY-IN SERVICE

For ninety days from purchase date, Motorola guarantees to pay labor charges for correction of product defects. For one year from purchase date, Motorola guarantees to exchange all defective parts. Exchange made with remanufactured Motorola parts. Guarantee is effective only when carried to and serviced by a Motorola authorized servicer during normal working hours. Guarantee does not cover installation, set-up, travel time or mileage, antenna system, adjustment of customer controls, foreign use (except Canada) or damage due to owner misuse.

*including model XT630H

console black and white TV*

ONE YEAR GUARANTEE ON ALL COMPONENT PARTS

For one year from purchase date, Motorola guarantees to exchange all defective parts. Exchange made with remanufactured Motorola parts. Labor charges are not included in this guarantee. They are paid by the owner. Guarantee is effective only when serviced by a Motorola authorized servicer during normal working hours. Guarantee does not cover installation, set-up, travel time or mileage, antenna system, adjustment of customer controls, foreign use (except Canada) or damage due to owner misuse.

*including table model XT778H.

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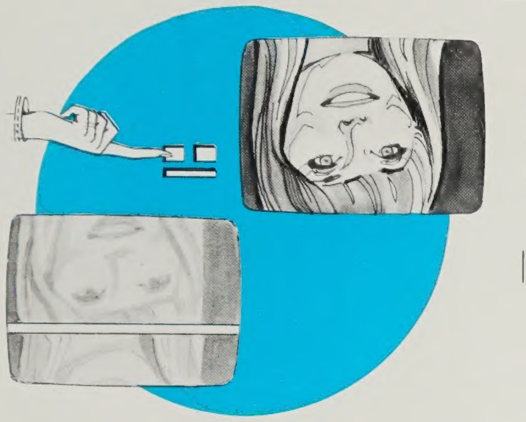
QUICK-SET

picture control

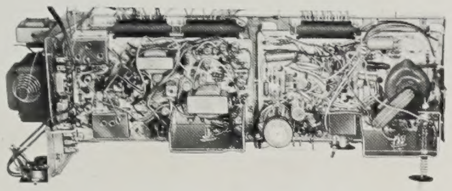
Now one button helps simplify operations of up-front secondary controls for brightness, contrast and vertical hold. If someone misadjusts these up-front secondary controls, pressing the "Quick-Set" button restores the pre-set picture. As long as the indicator light is on, pre-set balance is maintained from channel to channel and up-front controls are inoperable. (On models indicated.)



Simulated demonstration

SOLID STATE

Enjoy the reliability and long-life benefits of solid state components in Motorola sets with a 100% solid state chassis—no tubes. Unlike solid state components, tubes have heating filaments that can cause them to lose power, gradually lose performance and eventually burn out. You can select small screen solid state sets in 9" and 12" screen sizes (measured diagonally) and in big screen 21" and 22" sizes (measured diagonally) for portables, table and console models. In big screen solid state models, chassis components are mounted on plug-in mini-circuits (like they are in Motorola Quasar Color TV sets) for quick, easy service.



INSTANT PICTURE AND SOUND

Turn on your TV set and presto . . . picture and sound! There's little waiting—even in tube sets, because a special circuit keeps the chassis tubes in a "standby" condition for almost instant operation the moment the set is turned on. (On models indicated.)

A TV for "sleepy heads"

14" measured diagonally REMOTE CONTROL PORTABLE TV

with the "slumber" feature that shuts off the set even if you've fallen asleep.

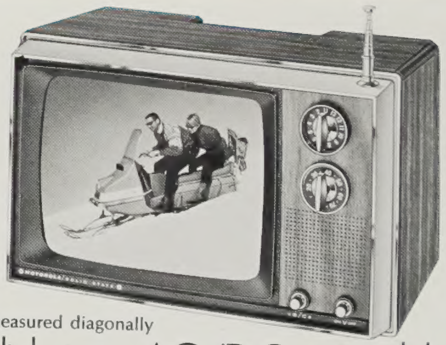
The ideal bedroom TV—even if you've fallen asleep for the night, this set turns itself off automatically when the TV station goes off the air. One-button, wireless remote control lets you change VHF channels (and one UHF channel pre-set at "U" setting), even turn set on and off. Pre-set picture control button helps maintain pre-set balance of brightness and contrast levels from channel to channel. And the private listening earphone lets you enjoy TV without disturbing others. Deluxe Walnut grain finished cabinet of high impact plastic. 15⅛" H, 14⅞" W, 11⅝" D. **Model AP406HW**

measured diagonally 12" portable TV with instant picture and sound

Smartly styled with a detachable sun shield included. A 74 square inch instant picture. Earphone jack for private listening. Magic-Mast up-front VHF antenna. High impact plastic cabinet in Walnut grain finish. 13⅝" H, 13⅞" W, 10" D. **Model BP318HW**

12" measured diagonally portable TV

This one packs plenty of performance to help give you a crisp, bright picture. Motorola's Fast-Back chassis slides out the back for easy service access. High impact plastic cabinet in Off-White color. 13⅝" H, 13⅞" W, 10" D. **Model BP309HH**



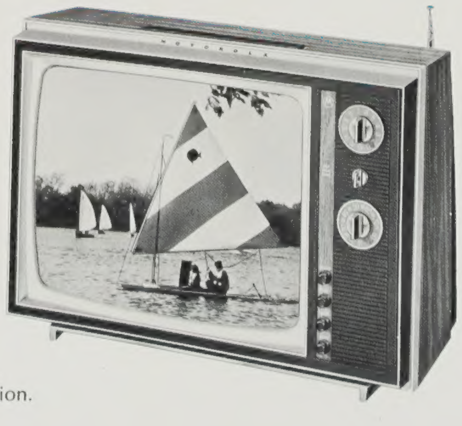
9" measured diagonally solid state AC/DC portable TV with built-in battery charger

Take TV enjoyment everywhere. This model plays indoors on regular AC current—plays outdoors on battery (optional extra) and plays in your car connected to cigarette lighter. Built-in battery charger automatically recharges recommended Eveready 561 battery when set is plugged into AC outlet and is not playing. 100% solid state chassis—no tubes, a 40 square inch screen, quick picture and sound, earphone and jack, snap-on sun shield and many other features. Walnut grain finished high impact plastic cabinet. 8½" H, 12½" W, 9⅝" D.

Model XP263HW

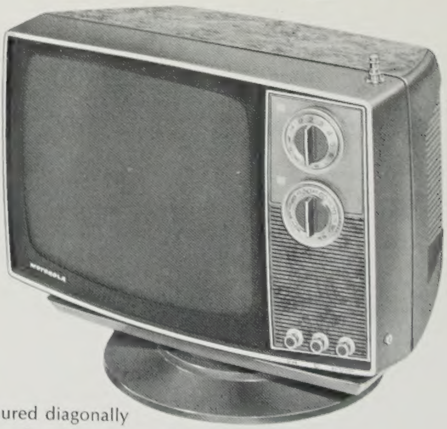
Portable Battery Pack (KT254HB) with power cord and shoulder strap available as optional extra.

TOTEABLES



measured diagonally 16" portable TV with instant picture and sound

Turn on the set and there's instant picture and sound . . . even an earphone jack for private listening. A big 141 square inch picture. Deluxe Walnut grain finished cabinet of high impact plastic. Monopole antenna. 14¼" H, 20¼" W, 11¾" D. **Model BP461HW**



12" measured diagonally solid state portable TV

Elegance plus the high reliability and long life of a 100% solid state chassis—no tubes. Instant Picture and Sound. A 360° Carousel swivel base. Detachable sun shield. Magic-Mast VHF up-front antenna. Earphone jack. Lighted dial. Handsome sculptured high impact plastic cabinet with Carpathian Elm Burl finish. Recessed side handle. 11¾" H, 15¼" W, 10⅜" D. **Model XP320GU**

All pictures shown on screens simulate TV reception.

SUPPLEMENT NO. 2
TO TS-918A SERVICE MANUAL,
PART NO. 68P65135A77

television

MANUAL 68P65135A79

CHASSIS TS-918A

MODELS RT606C, CU622C

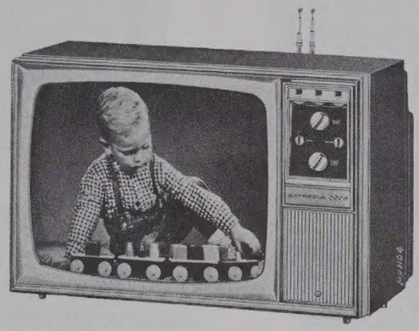
MOTOROLA

service manual

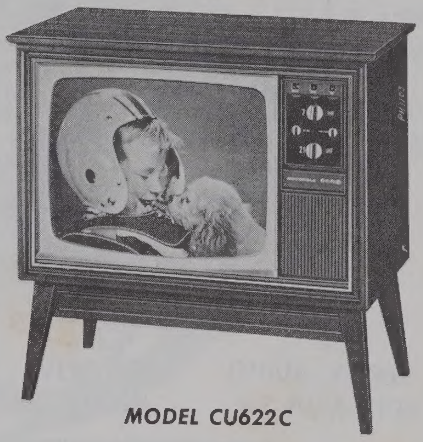
SUPPLEMENT NO. 2
TO TS-918A SERVICE MANUAL,
PART NO. 68P65135A77

GENERAL INFORMATION

This supplement introduces two (2) new models previously not listed. Included is all information pertinent to the unique portions of these new models. Refer to the "Table of Contents" for type of information included. For all other information, refer to the original TS-918A Service Manual, Part Number 68P65135A77.



MODEL RT606C



MODEL CU622C

MODEL BREAKDOWN CHART

MODEL	CHASSIS	VHF TUNER	UHF TUNER	CRT	ADDITIONAL CHASSIS
RT606CN	A20TS-918	AOPTT-399	HTT-624 or HTT-627	21GFP22	*TRR-6 & TRT-5
CU622CW	20TS-918	OPTT-399	HTT-624 or HTT-627	21GFP22	-----

*TRR-6 - Remote Control Receiver

*TRT-5 - Remote Control Transmitter

For service information pertaining to the TRR-6 and TRT-5, refer to the original TS-918A Service Manual, Part Number 68P65135A77.

MANUAL 68P65135A79
CHASSIS TS-918A
MODELS RT606C, CU622C
television

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PART NO. 68P65135A79 12-66 PRICE 75 CENTS

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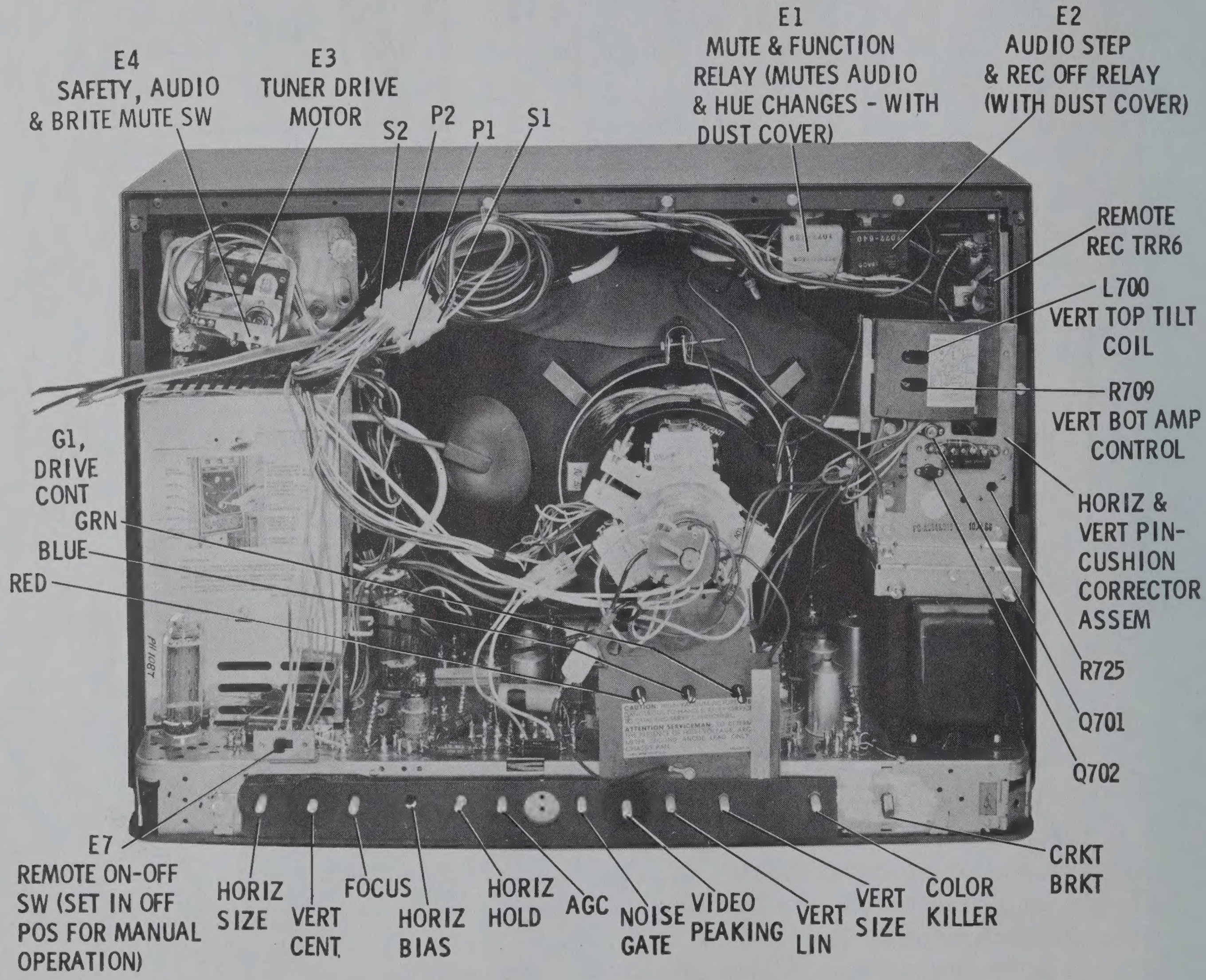
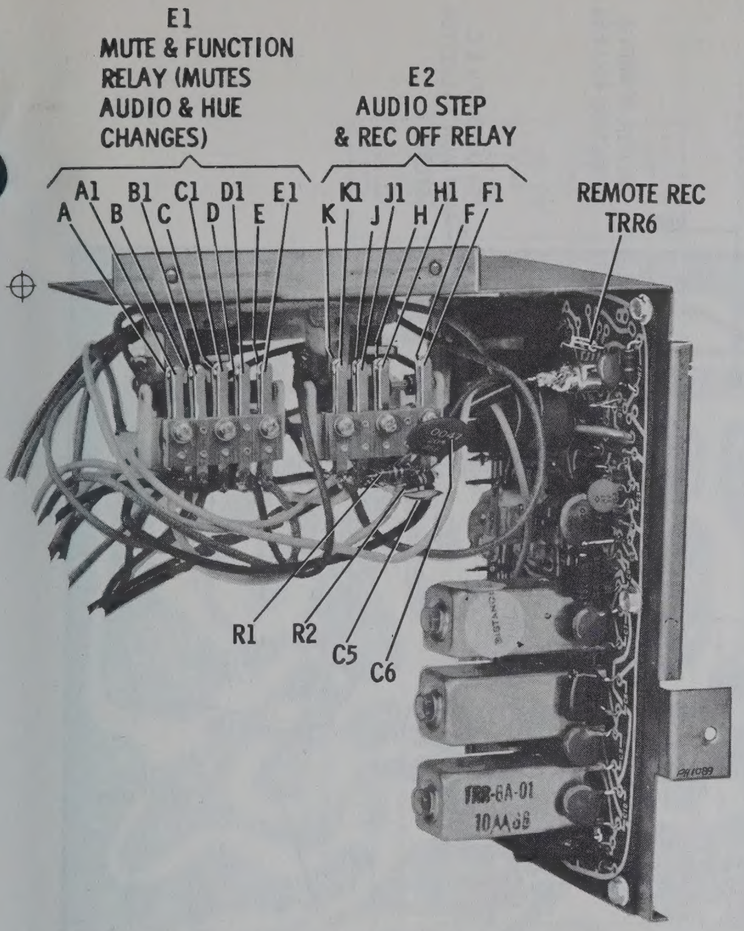
CHASSIS CODING CHANGES

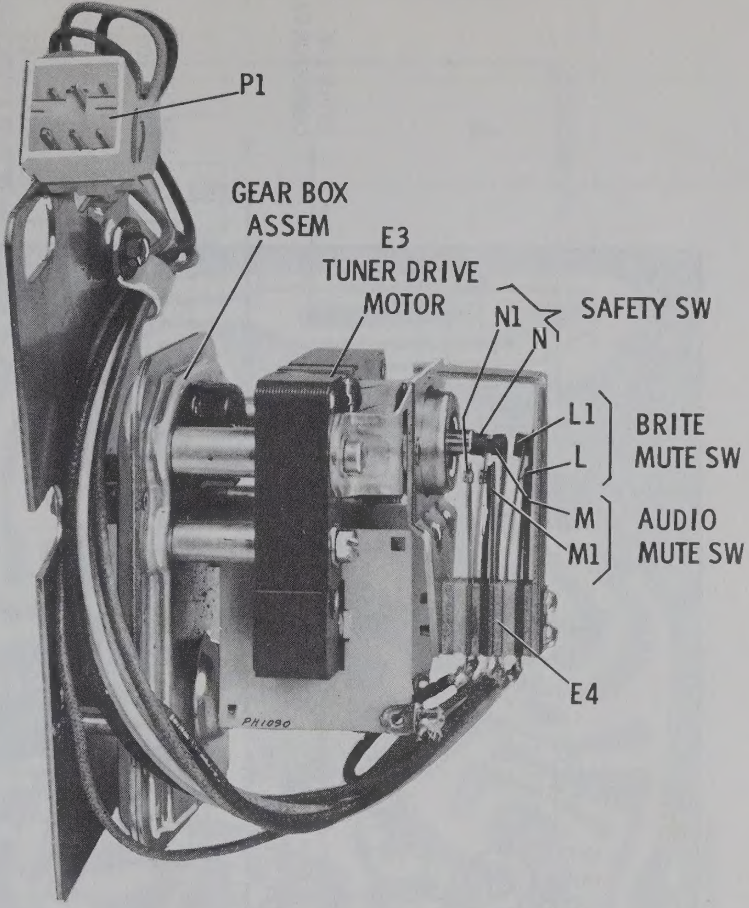
Chassis Coding	Chassis Coding Changes
TS-918A-01	SEE CODING CHANGE A-06.
TS-918A-02	TO IMPROVE PINCUSHION CORRECTION: Circuitry feeding correction voltage to pincushion corrector assembly has been slightly revised (see schematic diagram). R-620 has been deleted, R-731 (2.7K) replaced with 1.2K and R-732 (820 ohm) added.
TS-918A-03	RELIABILITY CHANGE: R-522, 120K, 1/2 watt boot filter resistor replaced with a 1 watt resistor. Also see "Coding Change A-05".
TS-918A-04	TO OBTAIN ADEQUATE 2ND ANODE VOLTAGE: Resistor, R-517 (33K), in horizontal output grid bias circuit replaced with 22K in some sets. If replacement is necessary, replace with original value.
TS-918A-05	RELIABILITY CHANGE: R-522, 120K, 1 watt boot filter resistor replaced with a 2 watt resistor.
TS-918A-06	RELIABILITY CHANGE: Horizontal output tube screen dropping resistor (10K, 10 watt) R-519 changed to a 12.5K, 10 watt. Increasing the value of this resistor to 12.5K improves horizontal output tube (6JS6) reliability and will accommodate the new horizontal output tube, 6LB6. NOTE: If the 6LB6 tube is used in sets coded earlier than A-06, the screen dropping resistor must be replaced with a 12.5K 10 watt unit, Part Number 17S135834.


E4
SAFETY, AUDIO & BRITE MUTE SW
E3
TUNER DRIVE MOTOR
S2
P2
P1
S1
E1
MUTE & FUNCTION RELAY (MUTES AUDIO & HUE CHANGES - WITH DUST COVER)
E2
AUDIO STEP & REC OFF RELAY (WITH DUST COVER)
REMOTE REC TRR6
L700
VERT TOP TILT COIL
R709
VERT BOT AMP CONTROL
HORIZ & VERT PIN-CUSHION CORRECTOR ASSEM
R725
Q701
Q702
CRKT BRKT
G1, DRIVE CONT
GRN
BLUE
RED
E7
REMOTE ON-OFF SW (SET IN OFF POS FOR MANUAL OPERATION)
HORIZ SIZE
VERT CENT.
FOCUS
HORIZ BIAS
HORIZ HOLD
AGC
NOISE GATE
VIDEO PEAKING
VERT LIN
VERT SIZE
COLOR KILLER

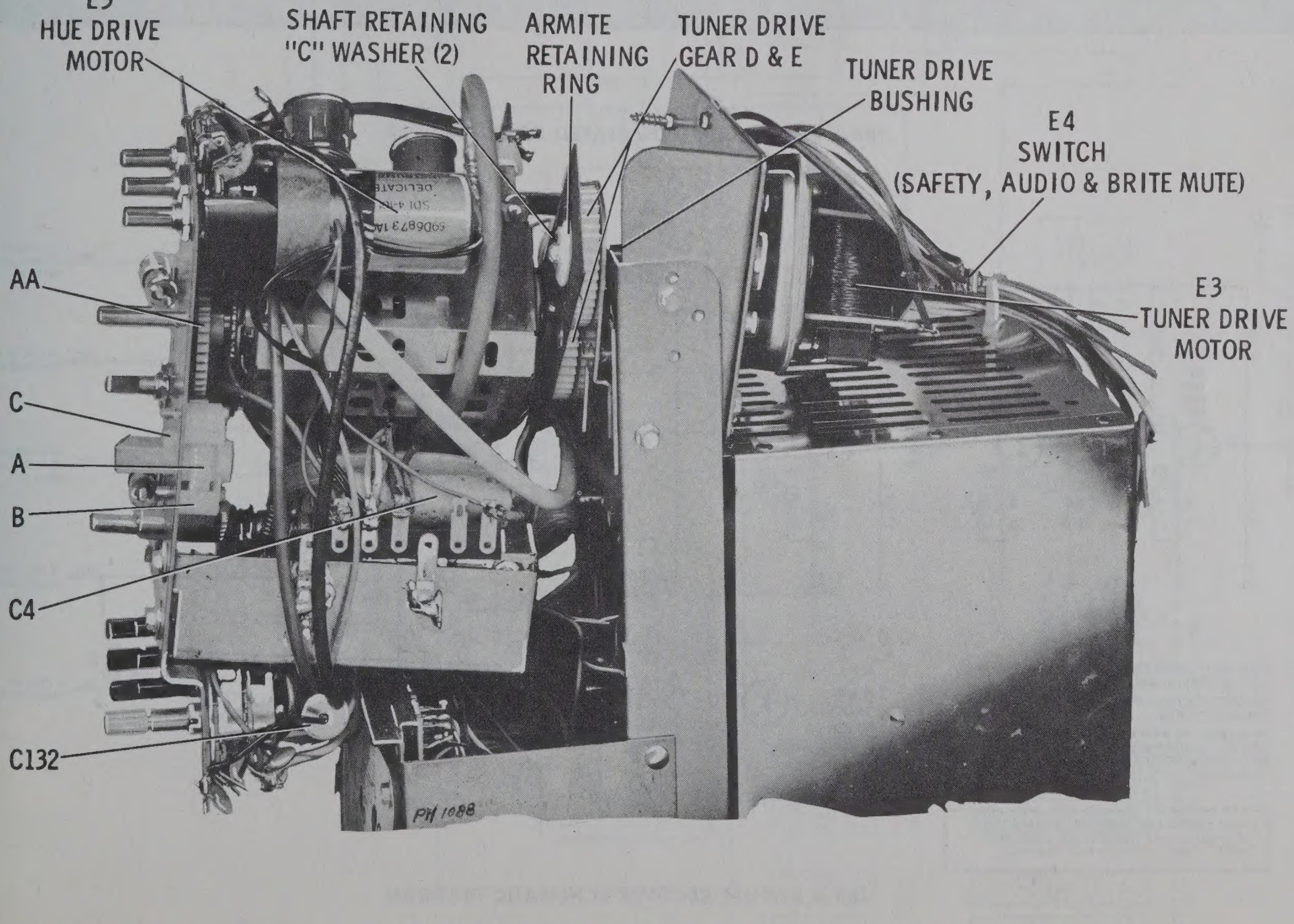
REMOTE RECEIVER - REAR VIEW


E1
MUTE & FUNCTION
RELAY (MUTES
AUDIO & HUE
CHANGES)
E2
AUDIO STEP
& REC OFF RELAY
A1
B1
C1
D1
E1
A
B
C
D
E
K1
J1
H1
F1
K
J
H
F
REMOTE REC
TRR6
R1
R2
C5
C6
TRR-6A-01
PH1089

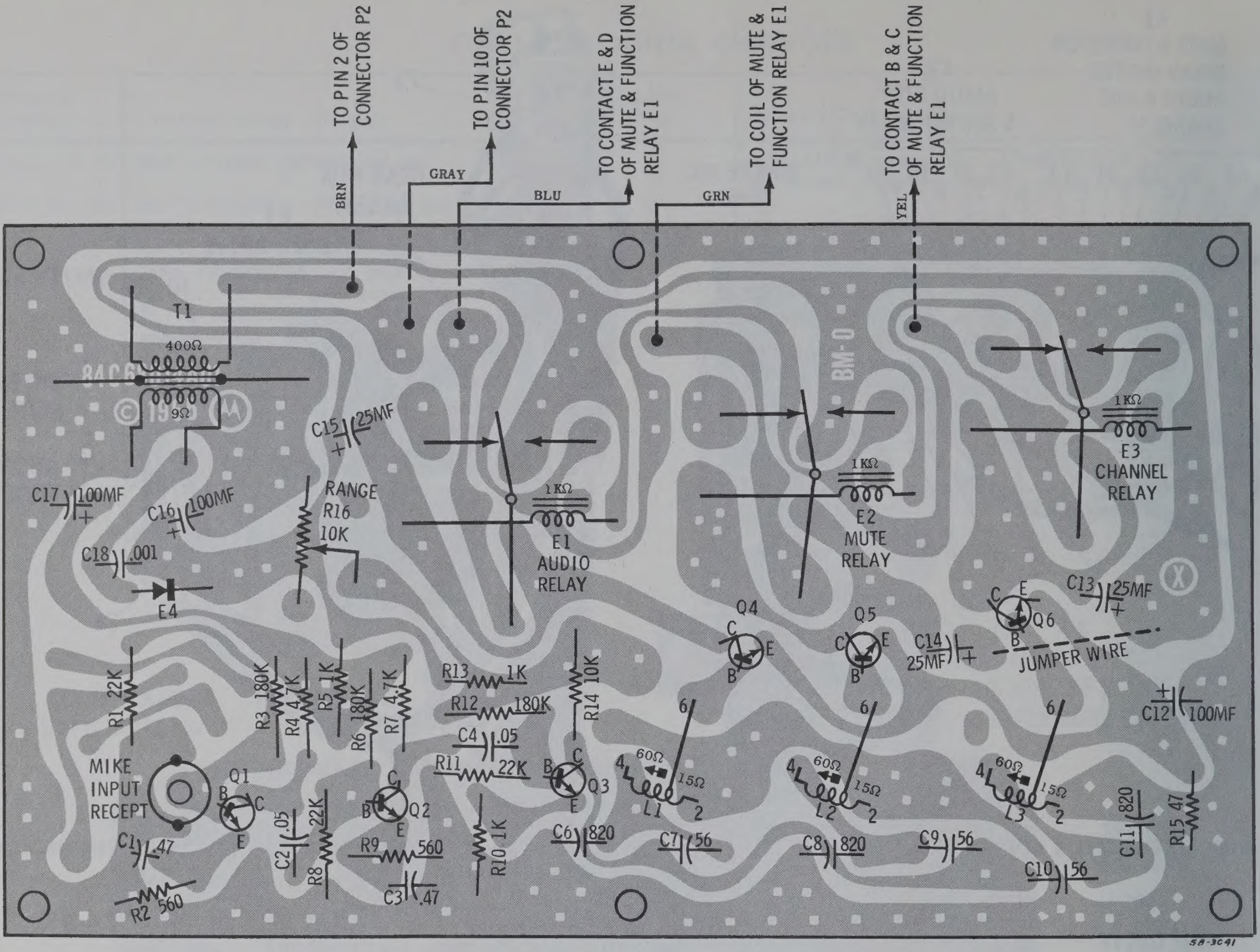
STEP RELAY PARTS & CONTACT IDENTIFICATION


P1
GEAR BOX
ASSEM
E3
TUNER DRIVE
MOTOR
N1
N
SAFETY SW
L1
L
BRITE
MUTE SW
M
M1
AUDIO
MUTE SW
E4
PH1090

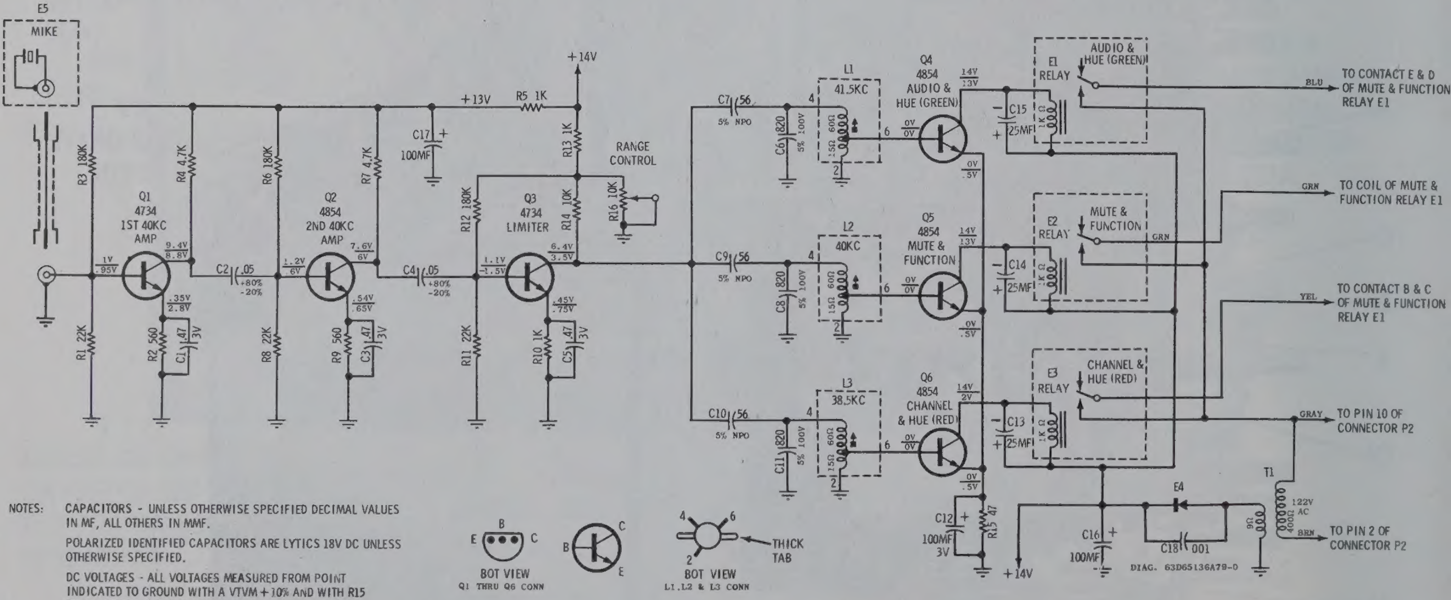
TUNER DRIVE MOTOR ASSEMBLY - COMPONENT IDENTIFICATION


E5
HUE DRIVE
MOTOR
SHAFT RETAINING
"C" WASHER (2)
ARMITE
RETAINING
RING
TUNER DRIVE
GEAR D & E
TUNER DRIVE
BUSHING
E4
SWITCH
(SAFETY, AUDIO & BRITE MUTE)
E3
TUNER DRIVE
MOTOR
AA
C
A
B
C4
C132
PH 1088

REMOTE CONTROL PANEL COMPONENT IDENTIFICATION


TO PIN 2 OF CONNECTOR P2
TO PIN 10 OF CONNECTOR P2
TO CONTACT E & D OF MUTE & FUNCTION RELAY E1
TO COIL OF MUTE & FUNCTION RELAY E1
TO CONTACT B & C OF MUTE & FUNCTION RELAY E1
BRN
GRAY
BLU
GRN
YEL
T1
400Ω
9Ω
C15 25MF
C17 100MF
C16 100MF
C18 .001
E4
RANGE R16 10K
1KΩ
E1 AUDIO RELAY
E2 MUTE RELAY
E3 CHANNEL RELAY
BM-0
Q4
Q5
Q6
C13 25MF
C14 25MF
JUMPER WIRE
C12 100MF
R1 22K
R3 180K
R4 4.7K
R5 1K
R6 180K
R7 4.7K
R13 1K
R12 180K
R14 10K
C4 .05
R11 22K
MIKE INPUT RECEPT
Q1
Q2
Q3
C2 .05
R8 22K
R9 560
R10 1K
C1 .47
C3 .47
R2 560
C6 820
C7 56
C8 820
C9 56
C10 56
C11 820
R15 47
L1
L2
L3
60Ω
15Ω
5B-3C41

TRR-6 REMOTE RECEIVER PLATED BOARD WIRING


E5
MIKE
+14V
+13V
R5 1K
C17 100MF
R3 180K
R4 4.7K
Q1 4734 1ST 40KC AMP
R6 180K
Q2 4854 2ND 40KC AMP
R7 4.7K
R12 180K
Q3 4734 LIMITER
R13 1K
R14 10K
RANGE CONTROL
R16 10K
C2 .05 +80% -20%
C4 .05 +80% -20%
R1 22K
R2 560
C1 .47 3V
R8 22K
R9 560
C3 .47 3V
R11 22K
R10 1K
C5 .47 3V
C7 56 5% NPO
C9 56 5% NPO
C10 56 5% NPO
C6 820 100V
C8 820 100V
C11 820 100V
L1 41.5KC
L2 40KC
L3 38.5KC
60Ω
15Ω
Q4 4854 AUDIO & HUE (GREEN)
Q5 4854 MUTE & FUNCTION
Q6 4854 CHANNEL & HUE (RED)
C15 25MF
C14 25MF
C13 25MF
E1 RELAY
E2 RELAY
E3 RELAY
AUDIO & HUE (GREEN)
MUTE & FUNCTION
CHANNEL & HUE (RED)
1K Ω
TO CONTACT E & D OF MUTE & FUNCTION RELAY E1
TO COIL OF MUTE & FUNCTION RELAY E1
TO CONTACT B & C OF MUTE & FUNCTION RELAY E1
TO PIN 10 OF CONNECTOR P2
TO PIN 2 OF CONNECTOR P2
BLU
GRN
YEL
GRAY
BRN
C12 100MF 3V
R15 47
C16 100MF
C18 .001
E4
T1
9Ω
400Ω
122V AC
+14V
BOT VIEW Q1 THRU Q6 CONN
BOT VIEW L1, L2 & L3 CONN
THICK TAB
DIAG. 63D65136A79-0

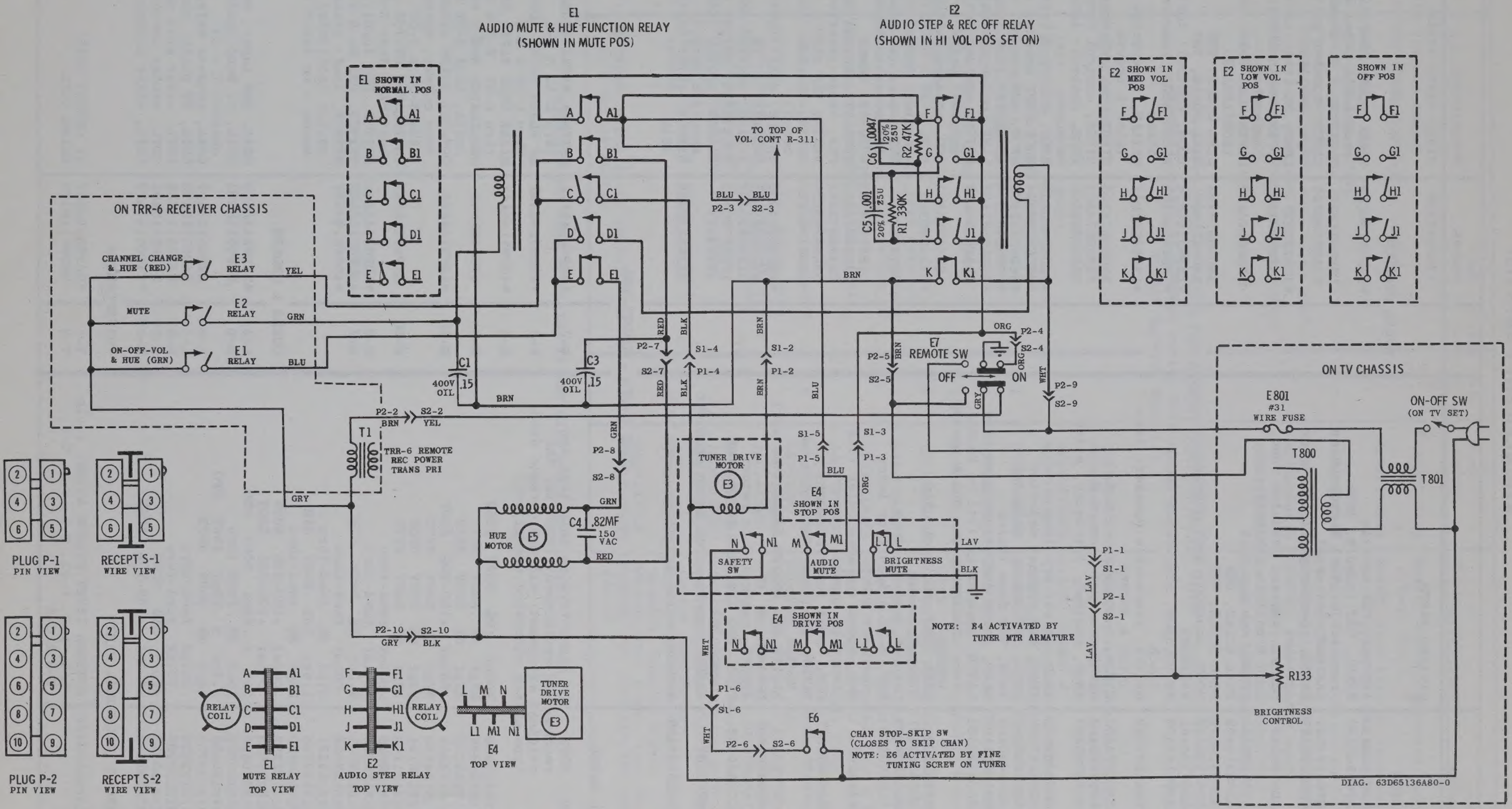
NOTES: CAPACITORS - UNLESS OTHERWISE SPECIFIED DECIMAL VALUES IN MF, ALL OTHERS IN MMF.

POLARIZED IDENTIFIED CAPACITORS ARE LYTICS 18V DC UNLESS OTHERWISE SPECIFIED.

DC VOLTAGES - ALL VOLTAGES MEASURED FROM POINT INDICATED TO GROUND WITH A VTVM + 10% AND WITH R15 MECH. CENTERED (VOLTAGES WILL VARY WITH DIFFERENT R15 SETTINGS).

WHERE 2 VOLTAGES ARE SHOWN, UPPER VOLTAGE IS WITH NO SIGNAL IN.LOWER VOLTAGE IS WITH STRONG 38.5KC SIGNAL (TRANS. APPROX. 6" AWAY FROM MIKE).

TRR-6 REMOTE RECEIVER SCHEMATIC DIAGRAM


E1
AUDIO MUTE & HUE FUNCTION RELAY
(SHOWN IN MUTE POS)
E2
AUDIO STEP & REC OFF RELAY
(SHOWN IN HI VOL POS SET ON)
E1 SHOWN IN NORMAL POS
E2 SHOWN IN MED VOL POS
E2 SHOWN IN LOW VOL POS
SHOWN IN OFF POS
A A1 B B1 C C1 D D1 E E1
F F1 G G1 H H1 J J1 K K1
TO TOP OF VOL CONT R-311
C6 .0047 20% 25U
R2 47K
C5 .001 20% 25U
R1 330K
ON TRR-6 RECEIVER CHASSIS
CHANNEL CHANGE & HUE (RED)
E3 RELAY
MUTE
E2 RELAY
ON-OFF-VOL & HUE (GRN)
E1 RELAY
C1 400V OIL .15
C3 400V OIL .15
T1
TRR-6 REMOTE REC POWER TRANS PRI
C4 .82MF 150 VAC
HUE MOTOR
E5
TUNER DRIVE MOTOR
E3
E4 SHOWN IN STOP POS
SAFETY SW
AUDIO MUTE
BRIGHTNESS MUTE
E4 SHOWN IN DRIVE POS
N N1 M M1 L1 L
NOTE: E4 ACTIVATED BY TUNER MTR ARMATURE
E7 REMOTE SW
OFF ON
ON TV CHASSIS
E801 #31 WIRE FUSE
ON-OFF SW (ON TV SET)
T800
T801
R133
BRIGHTNESS CONTROL
E6
CHAN STOP-SKIP SW (CLOSES TO SKIP CHAN)
NOTE: E6 ACTIVATED BY FINE TUNING SCREW ON TUNER
DIAG. 63D65136A80-0
P2-2 S2-2 P2-3 S2-3 P2-4 S2-4 P2-5 S2-5 P2-7 S2-7 P2-8 S2-8 P2-9 S2-9 P2-10 S2-10 P2-1 S2-1 P2-6 S2-6
S1-1 P1-1 S1-2 P1-2 S1-3 P1-3 S1-4 P1-4 S1-5 P1-5 P1-6 S1-6
YEL GRN BLU BRN RED BLK GRY ORG WHT LAV
PLUG P-1 PIN VIEW
RECEPT S-1 WIRE VIEW
PLUG P-2 PIN VIEW
RECEPT S-2 WIRE VIEW
1 2 3 4 5 6 7 8 9 10
RELAY COIL
E1 MUTE RELAY TOP VIEW
E2 AUDIO STEP RELAY TOP VIEW
L M N L1 M1 N1
E4 TOP VIEW

REMOTE CONTROL WIRING DIAGRAM

REPLACEMENT PARTS LIST

Ref. No.	Part Number	Description
		CABINET PARTS
MODEL RT606CN		
	85P65133A40	ANTENNA, UHF bow-tie
	*13P65146A48	BEZEL, CRT: complt; less removeable panel & escutcheon
	*16F68174C01	CABINET, 21" metal
	55A68196A01	CATCH, speaker grille (on spkr grille)
	43B67666A01	COLLAR, VHF ant (retains tube, rod & ball in cabinet)
	*15F68192A03	COVER, cabinet back
	34D68216A02	DIAL SCALE, UHF
	34D68216A01	DIAL SCALE, VHF
	*15P65146A49	DOOR, control: incl overlay
	50D67734A01	EARPHONE
	13D68186A02	ESCUTCHEON, removeable bezel: black
	*13E68207B02	GRILLE, removeable speaker: less latch & screws
	55B66674A03	HINGE, control door: L.H.
	55B66674A04	HINGE, control door: R.H.
	36C68236A03	KNOB, control: intensity, brite & hue
	36D68420A03	KNOB, on-off & volume
	36D68217A08	KNOB, UHF channel selector
	36D68217A07	KNOB, VHF channel selector
	36D68420A04	KNOB, VHF fine tuning
	65S10081A04	LAMP, color indicator: glow type
	55A68194A01	LATCH, speaker grille: on bezel: less shoulder screw nut & spring washer
	30S183A09	LINE CORD, AC: incl clip
	13B68187A01	OVERLAY, bezel
	13C68211A03	OVERLAY, control door
	*2S10080A09	NUT, 6-32 x 5/16 (for latch shoulder screw)
	2K748197	NUT, speed (secures color lite assem to bezel)
	22A66672A01	PIN, hinge (control door)
	*3A68195A02	SCREW, shoulder (for latch on bezel)
	1C67859A01	SLEEVE AND SPRING ASSEM (VHF ant)
	50D68384A01	SPEAKER, 4" PM
	41A66675A01	SPRING, control door return
	1C67665A02	TUBE, ROD AND BALL ASSEM (VHF monopole)
	4S754127	WASHER, spring (for latch shoulder screw)
	61P65145A35	WINDOW, color indicator: less bulb

Ref. No.	Part Number	Description
	1V66547A98	WIRED PANEL ASSEM: incl springs (makes contact with dipole ant)
MODEL CU622CW		
	*13P65146A13	BEZEL, CRT: complt: less removeable panel & escutcheon
	16F68766A01	CABINET, T.V. console: walnut
	55A68196A01	CATCH, speaker grille (on spkr grille)
	*30S183A13	CORD, AC line: incl clip
	15F68293A02	COVER, cabinet back: less all components
	15D68244A02	COVER, CRT rear (USE 15D67156A02)
	34D68216A02	DIAL SCALE, UHF
	34D68216A01	DIAL SCALE, VHF
	*15P65146A14	DOOR, control: incl overlay
	*13D68186A01	ESCUTCHEON, removeable bezel: black
	*13E68207B01	GRILLE, removeable speaker: less latch & screws
	55B66674A03	HINGE, control door: left
	55B66674A04	HINGE, control door: right
	36C68236A03	KNOB, control: intensity, brite & hue
	*36D68420A05	KNOB, on-off & volume
	*36D68217A04	KNOB, UHF channel selector
	*36D68217A03	KNOB, VHF channel selector
	*36D68420A06	KNOB, VHF fine tuning
	*65S10081A04	LAMP, color indicator: glow type
	55A68194A01	LATCH, speaker grille: less shoulder screw (on bezel)
	16B68785A01	LEG, cabinet: walnut
	*2S10080A09	NUT, 6-32 x 5/16 (for latch shoulder screw)
	2K748197	NUT, speed (secures color lite ind assem to bezel)
	13B68187A01	OVERLAY, bezel
	*13C68211A01	OVERLAY, control door
	22A66672A01	PIN, hinge (control door)
	55C63659A20	PLATE, leg mtg
	*3A68195A02	SCREW, shoulder (for latch on bezel)
	*26B65584A05	SHIELD, dial light
	50D68384A01	SPEAKER, 4" PM
	41A66675A01	SPRING, control door return
	16B68786A01	STRETCHER, bottom cabinet
	4S754127	WASHER, spring (for latch shoulder screw)
	61P65145A35	WINDOW, color indicator: less bulb

VHF TUNER - AOPTT-399

Ref. No.	Part Number	Description
ELECTRICAL PARTS		
CAPACITORS - NOTE: The capacitors in this list are recommended replacement types for the original equipment; all are ceramic disc type unless otherwise specified.		
C-1	21S410036	100pf 10% 500V N750
C-2	21S124946	27pf 5% 500V N470
C-3	*21S180C26	43pf 5% 500V N470
C-4	21S132293	.001mf +100-20% 500V
C-5	21S124946	27pf 5% 500V N470
C-6	21S132144	30pf 5% 500V N750
C-8	21S131104	12pf 5% 500V N470
C-9	21S132925	.001mf feed-thru
C-10	21S132925	.001mf feed-thru
C-11	21S129761	2.2pf 5% 500V GIM
C-12	21S132925	.001mf feed-thru
C-13	21S134221	47pf 5% feed-thru
C-15	21S132793	1.6pf 10% 500V GIM
C-16	21S134220	33pf 5% feed-thru
C-17	21S132293	.001mf +100-20% 500V
C-18	21S132925	.001mf +100-20% 500V
C-19	21S470326	2pf ± .25pf 500V NPO
C-20	21S120656	15pf 5% feed-thru
C-21	21S180A23	5.8pf ± .25pf 500V NPO
C-22	*21S138751	18pf 3% 500V N220
C-23	21S132925	.001mf feed-thru
C-24	21S132925	.001mf feed-thru
C-25	21S125529	470pf 20% 500V
C-26	21S132293	.001mf +100-20% 500V
MISCELLANEOUS ELECTRICAL PARTS		
E-1	*24P65144A40	ANTENNA INPUT FILTER ASSEM: incls L-1, L-2, L-31, T-2, C-1, C-2, C-3 & C-5

Ref. No.	Part Number	Description
E-2	*40P65144A41	ANTENNA WAFER ASSEM: incls L-9 thru L-13 & R-1
E-3	*40P65144A42	RF PLATE WAFER ASSEM: incls L-15 thru L-20 & R-3
E-4	*40P65144A43	MIXER GRID WAFER ASSEM: incls L-22 thru L-27, R-7 & R-10
E-5A	1P65121A40	OSCILLATOR ROTOR ASSEM: incls coils; less E-5B & E-5C
E-5B	*1P65144A46	PRE-SET SCREW ASSEM: incls gear head screws, spring & holder; less E-5A & E-5C
E-5C	47P65118A44	OSCILLATOR STATOR ASSEM: incls contacts; less E-5A & E-5B
E-6	*40P65144A44	SWITCH, UHF input: incls C-4 & L-4
E-7	*40P65144A45	SWITCH, UHF B+ & dial light
	*40P65144A87	SWITCH, leaf: channel stop skip switch (activated by fine tune screw - on tuner front)
COILS & CHOKES		
L-4	*24P65144A38	COIL, UHF input: series
L-6	24P65118A92	COIL, hi band neutralizing: channel 7 - 13
L-8	24P65114A27	COIL, antenna wafer: channel 13
L-14	24P65115A76	COIL, RF plate: channel 13
L-21	24P65114A35	COIL, mixer grid wafer: channel 13
L-28	24P65118A81	COIL, master oscillator
L-30	*24P65144A39	COIL, mixer screen
TRANSFORMERS		
T-1	*24P65144A37	IF OUTPUT COIL
T-2	24P65118A90	BALUN COIL

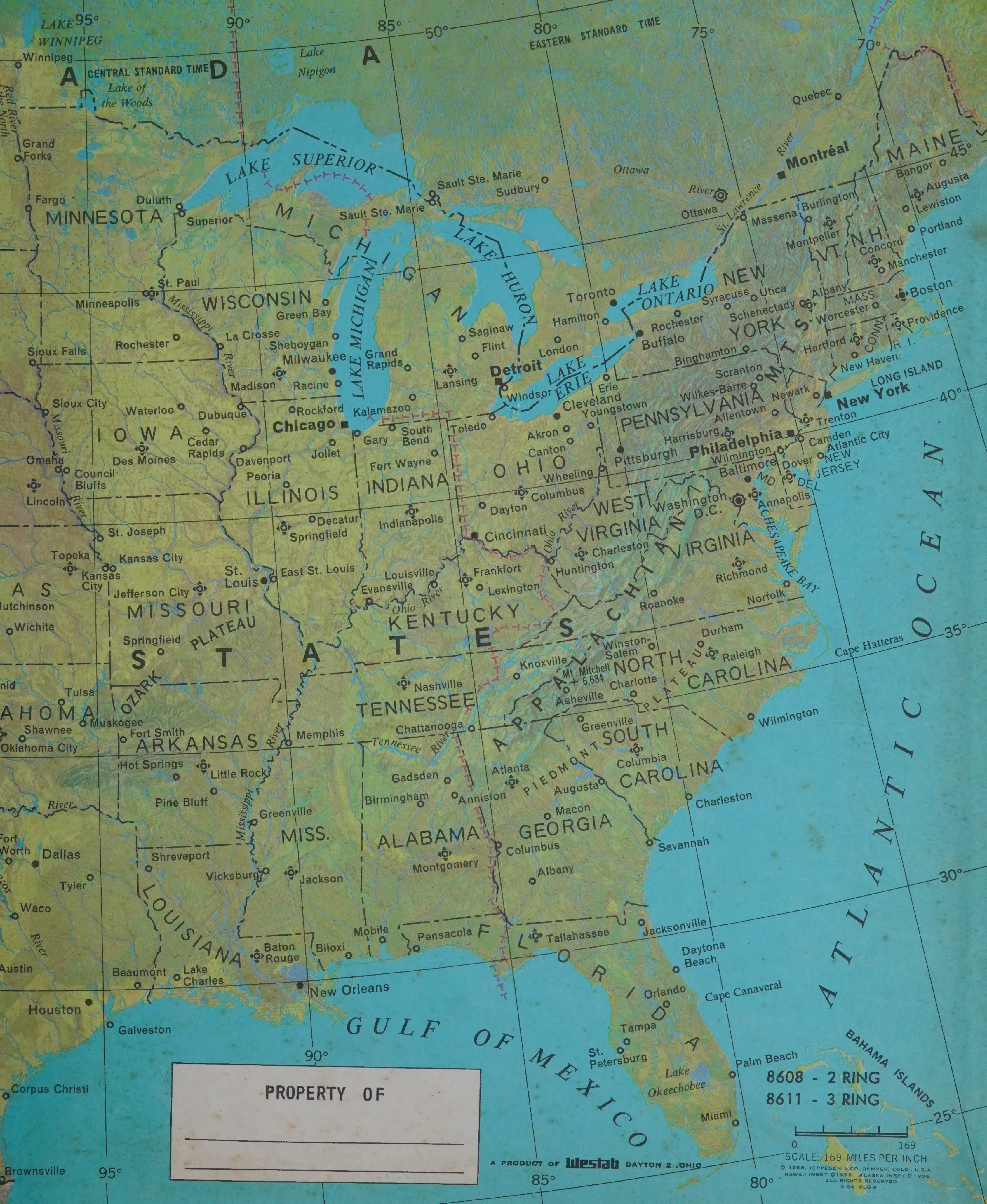
Ref. No.	Part Number	Description
MECHANICAL PARTS		
	*77D68159A04	VHF TUNER AOPTT-399: complt
	44P65146A15	GEAR, fine tune: nylon (engages fine tuning screws)
AA	44P65146A45	GEAR, fine tuning (on fine tuning shaft)
	1V65120A46	IDLER GEAR ASSEM: incl idler gear, fine tune gear and drive link
	2P65118A35	NUT, tinnerman: secures oscillator rotor to shaft
	3P65119A96	SCREW, fine tuning: gear head
	*47P65146A12	SHAFT, channel selector: incl detent wheel
	47P65146A44	SHAFT, fine tuning: incl metal drive gear, plate and nylon gear
	41P65120A43	SPRING, bias: retains shaft on front plate
	41P65120A39	SPRING, detent and shaft grounding
	42P65120A38	SPRING, fine tuning shaft retainer
	4P65114A53	WASHER, "C": (secures fine tuning gear on fine tune shaft)

UNIQUE REPLACEMENT PARTS FOR REMOTE CONTROL MODEL RT606

(For all other replacement parts, refer to the original TS-918 Service Manual.)

Ref. No.	Part Number	Description
ELECTRICAL & MISCELLANEOUS PARTS		
C-1 & C-3	8S134271	.15mf 20% 400V paper
C-4	*8C67779A09	.82mf 20% 150V AC oil imprg
C-5	21S410127	.001mf 20% 500V Z5F (USE 21R128045)
C-6	21S125890	.0047mf 20% 500V Z5F (USE 21K121764)
R-937	*18D68031A04	HUE CONTROL: less hue motor; 7500Ω
	*50C66208A05	MICROPHONE
E-1	80D65738A05	RELAY, step: incl leaf switch assem (mute, function selector)
E-2	80D65738A06	RELAY, step: incl leaf switch assem (audio step relay)
E-3	*1D68120A02	MOTOR AND GEAR BOX ASSEM: incl switches
	1D65989A17	GEAR BOX ASSEM: incl clutch return spring: less drive motor
E-4	1D65989A15	SWITCH, leaf: safety, brite mute and audio mute (on tuner motor)
	40P65144A87	SWITCH, leaf: channel stop-skip sw (on UHF tuner)
E-5	*59D68731A01	MOTOR, hue drive: incl hue control
E-7	*1V68607A94	SWITCH, D.P.D.T. slide: manual/ remote
MECHANICAL PARTS		
	*43A68795A01	BUSHING, motor drive shaft: less nut & spring washer
	43A754070	BUSHING, relay mtg
	30V66549A47	CABLE, COAX: incl plugs (for mute)
	42A65312A03	CLAMP, mike
	42C67981A01	CLIP, capacitor mtg (on bottom of UHF tuner mtg brkt)
P-1	15S10183A12	CONNECTOR, plug: 6 contact: less contacts
P-2	15S10183A14	CONNECTOR, plug: 10 contact: less contacts
S-1	15S10183A11	CONNECTOR, receptacle: 6 contact; less contacts
S-2	15S10183A13	CONNECTOR, receptacle: 10 contact; less contacts
	39S10184A02	CONTACT, plug (for 6 & 10 pin plugs - P-1 & P-2)
	39S10184A01	CONTACT, receptacle (for 6 & 10 pin receptacles - S-1 & S-2)
C	44C67370A02	GEAR, fine tuning: idler
A	44C67370A07	GEAR, fine tuning: incl shaft
D,E	*44B68797A01	GEAR, VHF tuner drive
	5K754071	GROMMET, relay mtg
	9C67498A01	JACK, earphone
	2A63473A01	NUT, knurled (for motor drive shaft bushing)
	28C67707A03	PLUG, phono (for mute coax cable)
B	42C67369A01	RETAINER, fine tuning gear
	*42S10128A02	RETAINING RING: plastic (retains armite gear cover)
	*47A68794A01	SHAFT, VHF tuner drive: less "C" washers, bushing & gear
	*9S10143A15	SOCKET, dial light, incl bracket
	*42S10219A05	WASHER, "C" (retains VHF tuner drive gears)

*DENOTES NEW ITEM APPEARING IN ANY LIST FOR FIRST TIME.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EASTERN STANDARD TIME
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Lake Nipigon
Lake of the Woods
Red River of the North
Winnipeg
Grand Forks
Fargo
Duluth
Superior
MINNESOTA
LAKE SUPERIOR
Sault Ste. Marie
Sudbury
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Quebec
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St. Lawrence River
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Miami
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ATLANTIC OCEAN
BAHAMA ISLANDS
Corpus Christi
Brownsville
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90°
85°
80°
75°
70°
50°
45°
40°
35°
30°
25°
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169
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8611 - 3 RING

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